[illegible]

BRITISH [illegible]
INSTRUCTOR:

Or, A New and [illegible] GUIDE to

PRACTICAL A[illegible]THMETIC,

WHEREIN

The Rudiments of Co[illegible]mon ARITHMETIC, [illegible]
and Decimal FRACTIONS, the Extraction and [illegible]
Square and Cube ROOTS, &c. [illegible] ſo eaſily [illegible]
and ſo plainly demonſtrated [illegible]
himſelf (in a ſhort Time) [illegible]
every Thing neceſſary to the [illegible]

To which is [illegible]

A POSTSCRIPT, for the U[illegible]
particular: Shewing, how to [illegible]
Tyling, Thatching, Brick-w[illegible]
gauge any Ciſtern, Piece of [illegible]

The Whole deſigned for [illegible]

Hitherto neglected, or have not ha[illegible]
acquainted with Figures; and attem[illegible]
DIALOGUES, in Order to render the [illegible]
ing, as well as uſeful to LEARNERS. [illegible]

Recommended by ſeveral eminent W[illegible]
Accomptants.

By DANIEL FENNING, A[illegible]
Algebraiſt's Companion, and *Deſcripti*[illegible]
GLOBES, both in Dialogues.

LONDON:
Printed for J. HODGES, at the *Looking*[illegible]
Magnus-Church, London-Bridge.
[Price bound Two Shillings [illegible]

BODLEIAN
P
15 MAR 1969
LIBRARY

DEDICATION.

To the SCHOOLMASTERS of

Great-Britain and *Ireland*.

GENTLEMEN,

THERE has been ſo man Books of ARITHMETIC publiſhed within theſe few Years, that, upon your firſt reading the Advertiſement of the following TREATISE, I think it is natural for ſome of you to accuſe me with Vanity, that I ſhould pretend to appear in Publick, after ſo many able Hands upon the Subject: But I hope you will conſider both the Deſign and Inducement, and permit me to make a fair and honeſt Apology, and then I leave every impartial Brother, and Lover of LEARNING, to give his Opinion.

I am very ſenſible, that many abler Hands have undertaken this before me, and have, in large Volumes, done *that* which cannot be expected to be found here: But as you are ſenſible too many of them have ſpent their Time, rather upon Curioſities than upon Buſineſs, (the very Thing that every Scholar ſhould particularly drive at, and which, I am ſenſible, every one of you would promote the Knowledge of) I have here made it my chief Care, to inform the Learner of every Thing that is neceſſary thereto.

It was not without Reluctance that I appear upon this Subject; but having publiſhed a ſmall Treatiſe of FRACTIONS and ALGEBRA, by Way of Dialogue, in 1750, which has met with great Encouragement, I was perſuaded by ſeveral Schoolmaſters, and private Gentlemen, to publiſh alſo a Piece of

ARITHMETIC, after the ſame Manner; as they were ſenſible, they ſaid, (and indeed, I confeſs, I think the ſame) that this Way of writing conveys the Matter better, and communicates Things ſooner to the Learner, than the bare ſetting of Sums, and not working them at all, or at leaſt, in a dry, intricate Manner.

As I do not pretend to recommend the Work, by comparing it with other Authors; ſo I hope, you will not condemn it, till you have peruſed it throughout.

'Tis true, that the Method of reducing *C's*, *qrs. lbs.* into *lbs.* (in Pages 208 and 209) is well worthy your Obſervations, it being as eaſy as it is new; and ſeveral Perſons in Buſineſs, to whom I have communicated it, never pretend to uſe any other Way for Eaſe and Expedition.

To ſuch of you, indeed, as are perfect Maſters of the Sciences, the Piece may appear inſignificant; but to others, I am ſenſible, the Dialogues will be of great Service, as they are intermixed with a Variety of familiar Examples, in natural Converſation: And I perſuade myſelf, they will be of great Help to your Pupils and, in a great Meaſure, eaſe you of that heavy Taſk, which every diligent Maſter (with a Number of Scholars) muſt of Neceſſity labour under.

This, Gentlemen, is one Reaſon why I built it upon this Plan; and I hope, for the Deſign's Sake, you will forgive thoſe Errors that have eſcaped me, and which you know are ſo common to the firſt Edition of ſuch a Work: And if ſuch of you as lie handy would give Notice thereof, you would highly oblige the AUTHOR, who wiſhes all of you, jointly and ſeparately, the beſt Succeſs in your Profeſſion and Undertakings; and deſires to ſubſcribe himſelf,

GENTLEMEN,

Your very humble Servant,

Royal-Exchange
Aſſurance-Office,
London, Dec.
11, 1753.

Daniel Fenning.

PRE-

THE

PREFACE.

Kind READER,

I Here preſent you with this ſmall Treatiſe of ARITHMETIC, which I have endeavoured to render as plain as Time, Room, or Price and Opportunity would admit of.

For ſuch of you, who have hitherto too much neglected this Branch of Education; and for others, who have neither Time, nor Opportunity, to apply to a proper Maſter, the following Work was chiefly deſigned; and was at firſt carried on no farther than the *Rule* *of Three Direct*: But I conſidered with myſelf, that it might fall into the Hands of many, who would be glad to have a Notion of *Fractions*. I have, therefore, to ſerve you, treated upon moſt of the Rules of *Arithmetic*, and for the Sake of thoſe that live in the Country in particular, I have given ſome Inſtructions to meaſure Timber, or a common Piece of Ground; as alſo, to gauge a Caſk, or Piece of Malt, and ſeveral other uſeful and practical Examples, which, I am perſuaded, will be of Service to you.

One Thing, which is ſeldom taken Notice of in a PREFACE, I would have every one of you, that are Learners, to obſerve, and that is, That if, upon the Trial of any Sum, or Queſtion, you do not find it the ſame as the Anſwer, do not let that diſcourage you; for if you examine your own Work after you have done it, and are ſo much Maſter of the Rules as to know when you are right or wrong; you may conclude you are right, whatever Anſwer you may find in my Work, or any other Author's: But before you determine this, mind and be ſure your own Work is right.

As to ſuch of you that have little or no Notion of Figures, if you have a Mind to learn, I am ſenſible you may very eaſily do it, with little or no Trouble; for I have taken the more Pains, that you might have the leſs: And if it does but anſwer the End of inſtructing ſuch of you as are quite ignorant, and improving others that have already ſome Knowledge of Figures, I ſhall look back upon the Undertaking with Pleaſure, notwithſtanding thoſe mean Criticiſms and Remarks, that may be made upon ſuch Overſights, which can hardly be avoided in a Work of this Sort.

But, every impartial Reader will conſider the Nature and Deſign of the Work: For 'tis the Plan upon which it is built that is to be minded: If *this* be plain and eaſy (as I hope it is) there is no Fear but the Learner will find a ſenſible Satisfaction, and the Work be crowned with Succeſs. As for ſuch *Carpers* that are reſolved to amuſe themſelves with the Bone only, they are extremely welcome; but let them be civil, and not ſnarl at thoſe that would eat the Fleſh quietly. I am,

Kind READER,

Your humble Servant,

and Well-wiſher,

London, Dec. 11, 1733.

Daniel Fenning.

TO THE

PUBLICK.

WE whoſe Names are hereunto ſubſcribed, having peruſed the Plan of this little Treatiſe of ARITHMETIC, do allow the Dialogues to be very well adapted to the Purpoſe: And as the Rules and Examples are laid down in a natural, eaſy, and familiar Manner, WE beg Leave to recommend it, as the moſt uſeful and eaſy Book for Learners extant.

Edmund Anguiſh, *Accomptant*
James Barclay, *Writing-Maſter.*
William Bently, *Surveyor*
George Coles, *Ditto*
Henry Deacon, *Accomptant*
Randall Evans, *Writing-Maſter*
Anthony Gilbert, *Surveyor*
Edward Griffiths, *Ditto*
Samuel Hill, *Philom.*
Thomas Humphreys, *Writing-Maſter*
Thomas Hughes, *Ditto*
Samuel Hornby, *Ditto*
Timothy Langley, *Accomptant*
Abraham Longden, *Ditto*
Abraham De Lire, *Philom.*

Thomas Newberry, *Philom.*
John Quant, *Writing-Maſter*
William Richardſon, *Ditto*
David Rowland, *Accomptant*
John Smyth, *Writing-Maſter*
James Smith, *Ditto*
Thomas Smithe, *Ditto*
John Smythe, *Accomptant*
Zachary Snaper, *Ditto*
Eraſmus Turner, *Ditto*
Johnſon Thompſon, *Writing-Maſter*
James Thurſton, *Ditto*
Daniel Trupker, *Ditto*
William Thorley, *Ditto*
James Thorpe, *Ditto*

To the RECOMMENDERS.

GENTLEMEN,

I Return you hearty Thanks for the honour you have done me, by the Favour of your Names to this little Treatiſe: Let me crave your further Aſſiſtance in noting down thoſe Errors that you may occaſionally find, and you will ſtill further oblige,

GENTLEMEN,

Your very humble Servant,

Dec. 11, 1753.

Daniel Fenning.

THE

INTRODUCTION.

CHAP. I.

DIALOGUE I.

Between PHILO, *a Tutor, or Maſter*; *and* TYRO, *a young Scholar*; *concerning the Rudiments of* ARITHMETIC.

TYRO *viſits* PHILO.

Tyro. DEAR Sir, I am your very humble Servant——You will pardon me, I hope——I hear you have done inſtructing *Tyrunculus*, and I am come to lay claim to a former Promiſe, of your giving me a better Notion of common *Arithmetic*.

Philo. You pleaſe me very much, young *Tyro*, I aſſure you, to ſee you ſo willing to learn; but I hear you underſtand the firſt four Rules already.

Tyro. When I was at School I had ſome Knowledge of them, as I thought; but it was not well-grounded; and when I left School, inſtead of practiſing at Home, and making myſelf Maſter of what I learnt there, I bent my Mind to Play and Idleneſs, like other naughty Boys; and were it not for your kind Offer, I ſhould know the Want of it too late. I chooſe therefore, Sir, to begin at the very loweſt Branch, that I may ſee the Reaſon of what I am doing, and not learn by Rote, as too many School-boys do, to the great Diſcredit of their Maſter, Grief of their Parents, and their own future Ruin.

Philo. You ſay very right; for in beginning again you will be confirmed in what you know already; for I ſhall proceed with you the ſame as if you never had began, that others may be the better informed; therefore, for their Sakes, do not you be angry, if I ſhould dwell upon ſome Things longer than you may think there is Occaſion for, ſince I tell you the Reaſon beforehand.

Tyro. Far be it from me, Sir, to take it amiſs; for though I do know ſomething of the firſt four Rules, I am ſenſible there are many Thouſands who know Nothing of the Matter, and you do well to conſider them alſo.

Philo. I am glad *Tyro* to ſee you ſo conſiderate; it gives me great Hopes of your being Maſter of what I am about to inſtruct you in.

DIALOGUE. II.

SECTION I.

Of Numeration, Addition *of* Whole Numbers, Money, Weights, *and* Meaſures, *&c.*

Tyro. WHAT is *Numeration*, and what does it teach?

Philo. *Numeration* is the true Diſtinction and Pronunciation of Number; that is, it teaches us to write down, read, and expreſs any Number or Numbers whatſoever: For the better underſtanding of which, obſerve the following Table.

N. B. The Letter C ſtands for an Hundred, and X for Ten.

TABLE.

	C of Millions.	X of Millions.	Millions.	C of Thouſands.	X of Thouſands.	Thouſands.	Hundreds.	Tens.	Units.
Places	9	8	7	6	5	4	3	2	1
	9	8	7	6	5	4	3	2	1
		9	8	7	6	5	4	3	2
			9	8	7	6	5	4	3
				9	8	7	6	5	4
					9	8	7	6	5
						9	8	7	6
							9	8	7
								9	8
									9

Note I.

This Table you ought to get by Heart, at leaſt, ſo as to underſtand the Nature of it.

Caſt your Eye now *Tyro* upon it; you ſee that there are nine Places of Figures from Units to Hundreds of Millions. All the Figures under the firſt Row are Units; thoſe in the ſecond Row towards the Left-hand, are under the Place of Tens; all in the third Row are called Hundreds; thoſe in the fourth Row Thouſands, *&c.*

Now, in Order to know the Value of, or how to expreſs any Number in the Table, I begin at the top Figure, towards the Right-hand, and ſay Units; (1) then Units, Tens, (Twenty-one, 21;) then Units, Tens, Hundreds, (three Hundred and Twenty-one, 3,21:) Thus I go on, and find the fourth Figure (*viz.* 4) under the Place or Name of Thouſands, and accordingly, I call it four Thouſand, which, joined to the other three Figures, will be four Thouſand, three Hundred, and Twenty-one, 4,3,21. The fifth Figure being in the Place of Tens of Thouſands, is thus read: Fifty-four Thouſand, three Hundred, and Twenty-one, 54,3,21. Thus proceed till you come to the laſt Figure of all, towards the Left-hand, (which ſtands in the Place of Hundreds of Millions) and you will eaſily perceive, that thoſe nine Figures are thus expreſſed: Nine Hundred, eighty-ſeven Millions, ſix Hundred, fifty-four Thouſand, three Hundred, and Twenty-one, 9,87,6,54,3,21. Read this once more, and obſerve the Comma's, or Stops, that are put to the Figures; for they anſwer to, or correſpond with, the Stops in the Words that are written out at Length.

NOTE 2.

You are further to obſerve, *Tyro*, that the *Numeration-Table* is not always ſet with theſe Figures, juſt in the Form they here ſtand; for had they been any other nine Figures, they are numbered and expreſſed after the ſame Manner: For Inſtance, ſuppoſe they were 1,2,3,4,5,6,7,8,9, this is expreſſed after the ſame Manner, only inſtead of 987 Million, it is now 123 Million; inſtead of 654 Thouſand, it is here 456 Thouſand; and inſtead of 381, it is now 789. So alſo, 9,99,9,99,9,99 is read thus:

Nine Hundred, ninety-nine Million, nine Hundred, ninety-nine Thouſand, nine Hundred, and Ninety-nine, &c. So that you ſee it is only having a due Regard to the Places under which the Figures ſtand; for you may ſee, that after the firſt three Places of Figures (*viz.* Units, Tens, and Hundreds) the next three Places have the Name of Thouſands, the next three the Place of Millions, as you may obſerve by the following Table, which, I believe, will be of Service.

TABLE 2.

Millions Place.	Thouſands Place.	Hundreds.	Tens.	Units.
1 2 3.	4 5 6.	7	8	9
1 2.	3 4 5.	6	7	8
1.	2 3 4.	5	6	7
	1 2 3.	4	5	6
	1 2.	3	4	5*
	1.	2	3	4
		1	2	3
			1	2
				1

Now here you ſee they are divided by Stops, or Periods, which is certainly a Help to the expreſſing the Numbers: Thus, Suppoſe I would expreſs the Number againſt which this Mark (*) is placed. I find the *Twelve* ſtands under the Place of Thouſands, ſo that I ſay it is twelve Thouſand, three Hundred, and Forty-five, &c.

Tyro. I perceive it, Sir, very plainly: But, pray what Uſe is the Cypher (0) of; or is it of no Signification?

Philo. It is of no Signification, when it ſtands alone, thus, (000,) or (0000,) all ſtand for Nothing: Nor is it of any Signification placed before any Figure or Figures, thus, 02 is but 2; and 0005 is but 5 ſtill, But when a

Cypher is put after Figures it makes them Ten, Twenty, Thirty, a Hundred, or a Thouſand Times more in Value. Thus 1, by adding a Cypher, is (10) Ten, add two Cyphers thus, 100, it is an Hundred, *&c.* as by the following Table.

TABLE 3.

1	One.
10	Ten.
100	An Hundred.
1000	A Thouſand.
10000	Ten Thouſand.
100000	An hundred Thouſand.
1000000	A Million.
10000000	Ten Million.
100000000	An hundred Million.
1000000000	A thouſand Million.
10000000000	Ten thouſand Million.
100000000000	An hundred thouſand Million.
1000000000000	Millions of Millions.

And thus you might go on as long as you pleaſe.

Tyro. I perceive it; but who could tell the Value, or expreſs ſo many Figures out of the Courſe of the Table?

Philo. You talk like a Learner indeed. You ſee the twelfth Figure, by the above Table, has the Name of an hundred thouſand Million; therefore, were there 3, 4, or 5 Times, or 5 hundred Times as many Figures, it would be as eaſy to number them in Order, as well as if there were but 5 in all.

Tyro. That is a little ſurprizing to me, I confeſs; for ſome think they can do great Things, to number 9 or 10 Figures only.

Philo. Well, *Tyro*, we will not call that Pride altogether; for Pride is good in Learners, ſo far as it tends to Emulation only; that is, an earneſt Deſire to excel in Learning: But, pray obſerve, Suppoſe I had ever ſo many Figures to number; you plainly ſee, by the laſt Table, that the ſeventh Figure is Millions Place, and that the thirteenth Place has the Name of Millions of Millions; ſo alſo the nineteenth Figure would be Millions of Millions of Millions: But as the Word Millions would be repeated ſo often in a very large Number of Figures, as to render it tireſome, there is a ſhorter and much eaſier Way of expreſſing the Number by certain Words, which anſwer to every ſeventh Figure, and to any Degree of Millions, as appears by the following Table.

TABLE 4.

Dots.	
1	The 7th Figure from the Units Place is Millions.
2	13 is Bimillions, or Millions of Millions.
3	19 is Trimillions, or the 3d Deg. of Millions.
4	25 is Quartrillions, or the 4th Deg. of Millions.
5	31 is Quintillions, or the 5th Deg. of Millions.
6	37 is Sexquillions, or the 6th Deg. of Millions.
7	43 is Septillions, or the 7th Deg. of Millions.
8	49 is Octillions, or the 8th Deg. of Millions.
9	55 is Nonnillions, or the 9th Deg. of Millions, or Millions 9 Times repeated, *&c.*

Suppoſe it were required to number the 57 following Figures, 321, 987, 654, 321, 987, 654, 321, 987, 654, 321, 987, 654, 321, 987, 654, 321, 987, 654, 321.

Here I make a Period or Dot over every 7th Figure, and find there are 10 Dots in all: Then ſearching in the above Table, I find the 9th Dot to bear the Name of Nonnillions, the 8th of Octillions, *&c.* Therefore, I number the above Figures thus; three Hundred 21 Nonnillions, 987 Thouſand; 654 Octillions, 321 Thouſand; 987 Septillions, 654 Thouſand; 321 Sexquillions, 987 Thouſand; 654 Quinquillions, 321 Thouſand; 987

Quartrillions, 654 Thouſand; 321 Trimillions, 987 Thouſand; 654 Bimillions, 321 Thouſand; 987 Million, 654 Thouſand, 321. And thus you may go on to as many more Places, &c. Or you may number them by the ſecond Part of the Table, and that is, by putting ſmall Figures where the Dots ſtand, as 1, 2, 3, 4, till you come to 9: Then begin, and ſay 32$\overset{9}{1}$ of the 9th Degree of Millions, 987 Thouſand; 65$\overset{8}{4}$ of the 8th Degree of Millions, &c. till you come to the End: And thus, by putting ſmall Figures over every 7th Figure, you may number to the 20th, 30th, or any higher Degree of Millions whatſoever.

Tyro. I underſtand you well; and though it is likely there may never be ſo many Figures in any Sum; yet, it is good to know how to number them when a Queſtion is aſked, though it be for Fancy's Sake only. But now, *Philo*, if you pleaſe, I will aſk you a few Queſtions, which I am at a Loſs to know.

Queſt. 1. How is *eleven Thouſand, eleven Hundred,* and *Eleven*, ſet down in 5 Figures?

Philo. I know this is a common Queſtion, and it is eaſily done, if you conſider; for this is the Anſwer 12,111, *viz,* twelve Thouſand, one Hundred, and Eleven.

Proof by ADDITION.

Eleven Thouſand is	11,000	add
Eleven Hundred is	1,100	
Eleven is	11	
	12,111	as above.

Queſt. 2. How is *fifteen Thouſand, fifteen Hundred,* and *Fifteen*, ſet down in five Figures? *Anſwer*, 16,515.

But you are to obſerve, *Tyro*, that though theſe Oddities are eaſily anſwered you ſee; yet, I would not have you be concerned with them, for they are very badly ex-

expreſſed, and are an Abuſe of Language: For, ſuppoſe you ſtood indebted to me, and ſhould aſk me what it was, and I ſhould ſay *fifteen Pounds, fifteen Shillings,* and *fifteen Pence*; would you not think it much better to ſay fifteen Pounds, ſixteen Shillings, and three Pence, for this would be in Order. Take this then for a Rule, *Tyro,* that *that* is the beſt Method of Expreſſion; that is, the ſhorteſt, freeſt, and moſt natural. Therefore, tho' the aforeſaid Numbers run a little ſmoother in Words than what I have now mentioned, the (Reaſon of which is, becauſe they are each but one whole Number) yet is the Senſe of expreſſing fifteen Thouſand, fifteen Hundred, and Fifteen, very little better than fifteen Pounds, fifteen Shillings, and fifteen Pence.

☞ Now there are ſeveral Things a little dark in Expreſſion, relating to Numbers, which are actually of Uſe when they are known. I imagine, *Tyro,* you now and then read good Books: You remember we read in the Book of *Kings,* and in *Iſaiah,* that an Angel deſtroyed, in the Camp of the *Aſſyrians,* an Hundred, and Fourſcore, and five Thouſand. How do you ſet this down properly?

Tyro. Why really, Sir, I am at a Loſs; and I have ſeen older Perſons than myſelf puzzled at it?

Philo. So have I; but it muſt be for Want of conſidering. Is not Fourſcore and five the ſame as 85: Therefore, the Number is one Hundred, eighty-five Thouſand, thus, 1,85000.

Again, you read in the *Revelations* of a Multitude of ten Thouſand Times ten Thouſand; which is 1,00000000, *viz.* one hundred Million: And a little further, you read of another, conſiſting of two hundred Thouſand Thouſand, which is, 2,00000000 Million, *viz.* two hundred Million, which you will ſee demonſtrated, *Example* the 3d and 4th in Compendiums of *Multiplication.*

I ſhall finiſh *Numeration* with ſome of the old *Roman* Numbers, as it may be of Service.

A TABLE *of Old* ROMAN *Numbers.*

L. ſignifies, or ſtands for (50) Fifty.
C. for an (100) Hundred.
CC. (200) Two Hundred.
CCC. (300) Three Hundred.
CCCC. (400) Four Hundred.
D. ſignifies (500) Five Hundred, or thus IƆ.
DC. ſtands for (600) Six Hundred, or thus IƆC.
DCC (700) Seven Hundred, or thus IƆCC.
DCCC (800) Eight Hundred, or thus IƆCCC.
DCCCC. (900) Nine Hundred, or thus IƆCCCC.
M. (1000) A Thouſand, or thus CIƆ.
MM. (2000) Two Thouſand, *&c.*

ROMAN *Numbers explained by* FIGURES.

DL. 550.
DCCX. 710.
MDXIV. 1514.
MDCLI. 1651.
MDCCIX. 1709.
MDCCLIII. 1753, *&c.*

And now, *Tyro*, we will proceed to *Addition.*

SECTION II.

Of ADDITION.

Tyra. WHAT do you mean by *Addition?*

Philo. Addition ſignifies the gathering, collecting, and adding together two or more Numbers into on Sum.

Tyro. How many Parts are there in *Addition?*

Philo. Two, *ſimple* and *compound.*

Tyro. What is *ſimple Addition?*

Philo. *Simple Addition* is that which conſiſts of one *ſimple* or *ſingle* Name; that is to ſay, of *whole Numbers* only, as *Pounds*, *Sterling*, *Tons*, *Yards*, *Ells*, or *Ounces*, *&c.* For Ten is Ten, and a Thouſand is a Thouſand, in any Number and Quantity; tho' the Quality or Name be different; and they are all added by one Rule, namely, by caſting out the Tens, and ſetting down in every Line what is over Ten, as you will ſee by and by.

Tyro. What does *Compound Addition* conſiſt of?

Philo. Of *Money*, *Weights*, and *Meaſures*, as alſo, *Averdupois-Weight*, *Troy-Weight*, *Apothecaries*, and *Goldſmiths-Weight*, &c. Likewiſe, *Dry-Meaſure*, *Liquid-Meaſure*, *Cloth-Meaſure*, *Square-Meaſure*, *Long-Meaſure*, *Land-Meaſure*, and *Time* Of theſe in their Order.

SECTION III.

ADDITION *of whole Numbers*.

THE Rule to be got by Heart is,

For every Ten in the Units Place, or firſt Row of Figures, you muſt carry one to the Tens Place, or ſecond Row, and ſo proceed; becauſe ten Units make Ten, ten Tens an Hundred, and ten Hundred a Thouſand.

The EXPLANATION.

Firſt. If there be but one Row of Figures, and in adding it up the whole ſhould not amount to Ten in all, you muſt ſet down under the Row what it comes to, be it 4, 5, or 9, or any other Figure, as in *Example* 1 and 2 following.

Add	2	3	2		9	
	1	2	1		7	
	1	1	4		8	
	5	2	3	and	4	together.
	—	—	—		—	
	9 *Anſ.*	8 *Anſ.*	10 *Anſ.*		28 *Anſ.*	

Here I ſay 5 and 1 is 6, and 1 is 7 and 2 is 9; which I place under the Numbers, and it is done: But to prove whether it be right, I begin at the Top and caſt it downwards, and find it comes to the ſame.

Secondly, If it amounts to juſt Ten and no more (as in *Example* 3) ſet it down as before; only ſet the Cypher under the Row, and ſet the Figure of 1 out towards the Left-hand. So alſo, in *Example* 4, I find it amounts to 28, which I ſet under the Row, the Units 8 under the Row itſelf, and the 2 towards the Left-hand in the Place of Tens.

Thirdly, When you have two or three Rows of Figures, then, according to the Rule, add up the firſt Row, or Units Place, and obſerve how many Tens it contains, and if it comes juſt to even Tens, ſet a Cypher underneath, and carry as many *Ones* to the next Row as there were *Tens* in it; that is, if it be 20, carry 2, if it be 30, carry 3, if 40, carry 4, and for 50, carry 5, *&c.* And the laſt Row of all ſet down what it amounts to, as if it were one ſingle Row only.

EXAMPLE 5.

Add 87625 Pounds
94915
62194
76547
81965
92198
and 71964 together.
———
567408 *Anſw.*

Now obſerve once for all. I begin, and ſay, 4 and 8 is 12, and 5 is 17, and 7 is 24, and 4 is 28, and 5 is 33, and 5 is 38; this is the Amount of the firſt Row, or Units Place, but I muſt not ſet down the whole 38, but ſee how many Tens it contains, and find it to be 3 Tens, and 8 over; this 8 I ſet under the Row, and carry 3 to the next Row, or Tens Place, ſaying, 3 that I carry and 6 is 9, and 9 is 18, and 6 is 24, and 4 is 28, and 9 is 37, and 1 is 38, and 2 is 40: This being juſt 4 Tens, I ſet down a Cypher, and carry 4 for the 4 Tens to the next Row, or Hundreds Place, ſaying, 4 and 9 is 13, *&c.* and I find the third Row to be 44, which is 4 Tens and 4 over; therefore, I ſet down 4, and carry 4 to the fourth Row, or Place of Thouſands, and find that it amounts to 27, then I ſet down the odd 7, and carry 2 to the fifth, or laſt Row, and find that it amounts to 56, and becauſe this is the laſt Row I ſet down the whole 56, that is, the 6 under the Row, and the 5 to the Left-hand.

Fourthly, When there are ſeveral Numbers to be added together, conſiſting ſome of fewer and ſome of more Figures, they are added after the ſame Manner as before, only obſerve, in ſetting down the Numbers on your Slate, or in a Book, that you be careful to ſet Units under Units, Tens under Tens, or elſe you will be puzzled in caſting them up.

Ex. 6 Suppoſe I were to add 3417, 26, 184, 9, 271, and 3 together: I ſet them down as follows, which will be a ſtanding Rule for any Thing of the like Nature.

EXAMPLE 6.

Loads.
3417
26
184
9
271
3

3910

Here you ſee I ſet Units under Units, and Tens under Tens, and then I caſt up from Row to Row as before directed.

Tyro. I underſtand it very well; but I ſhould have ſet it down thus, with Cyphers, to ſupply the vacant Places.

$$\begin{array}{r} 3417 \\ 0026 \\ 0184 \\ 0009 \\ 0271 \\ 0003 \\ \hline 3910 \end{array}$$

Philo. It is quite ſuperfluous; for you have been told already that Cyphers before Figures do not at all increaſe the Value; Beſides, it is neither ſo ſightly, nor advantageous to caſt up, nor are they ſeldom or ever uſed by Accomptants even in Addition of Money, to fill up any Line or Space whatſoever, as you will ſee in *Example* 13, of *Addition of Money*,

More Examples in Whole Numbers.

Buſhels.	*Ells.*	*Yards.*
471756	6715	65432
434176	46	2145
621985	9	234
942176	2176	67
354219	200	8
471625	6	76
982196	10	354
853294	1756	3256
	1	76258
5131427	10919	147830

And now, *Tyro*, I will ſet you two or three Queſtions by Way of Exerciſe.

QUESTIONS *to exerciſe* ADDITION *of Whole Numbers*

Queſt. 1. From *London* to *Rumford* is 11 Miles, from *Rumford* to *Brentwood* 6, from *Brentwood* to *Chelmſford* 11, from *Chelmſford* to *Witham* 8, from *Witham* to *Kelvedon* 4, from *Kelvedon* to *Colcheſter* 10, from *Colcheſter* to *Manningtree* 9, and from *Manningtree* to *Harwich* 12: How many Miles then is it from *London* to *Harwich*? *Anſwer*. 71.

Tyro. I apprehend the Queſtion; it is only ſetting down the Numbers as they ſtand in their Order, as under.

	Miles.
From *London* to *Rumford*	11
From *Rumford* to *Brentwood*	6
From *Brentwood* to *Chelmſford*	11
From *Chelmſford* to *Witham*	8
From *Witham* to *Kelvedon*	4
From *Kelvedon* to *Colcheſter*	10
From *Colcheſter* to *Manningtree*	9
From *Manningtree* to *Harwich*	12
From *London* to *Harwich*	71 *Anſ.*

Queſt. 2. A Farmer has 7 Fields, containing the following Acres, *viz.*

	Acres.	
In one Field are	25	How many Acres are there in all? *Anſ.* 192.
In another	57	
In another	18	
In another	25	
In another	15	
In another	43	
In another	9	

Anſ. 192 Acres.

Queſt. 3. A Draper has 6 Pieces of Cloth as under.

	Yards.
N° 1 Containing	87
2 —— ——	45
3 —— ——	17
4 —— ——	8
5 —— ——	32
6 —— ——	21
Anſ.	210 Yards.

How many Yards are there in all? *Anſ*. 210.

Queſt. 3. How many Days are there in the Year, or in the 12 Calendar Months? Firſt, ſet them down as follows.

	Days.
Firſt, *January* has ——	31
February —— ——	28
March —— ——	31
April —— ——	30
May —— ——	31
June —— ——	30
July —— ——	31
Auguſt —— ——	13
September —— ——	30
October —— ——	31
November —— ——	30
December —— ——	31
Anſ.	365 Days.

Note, Every fourth Year is called *Leap-Year*, and has 366 Days; *February* having then 29 Days.

Note, **That in marking of any Sort of Goods N° ſtands for Number.**

Queſt. 4. How far is it from *London* to *Carliſle* in *Cumberland*, when,

	Miles.
Fom *London* to *Newcaſtle* is	149
From *Newcaſtle* to *Preſton*	62
From *Preſton* to *Lancaſter*	21
From *Lancaſter* to *Penrith*	50
From *Penrith* to *Carliſle*	19

Anſ. 301 Miles.

Tyro. I underſtand what you have ſhewn me very well.

Philo. Then I ſhall only leave one Queſtion more for you to try at your Leiſure.

Add 47, 697, 5, 91707, 100000, 26300175, 500, 62, and 987654321 together? *Anſ.* 1014147514.

To prove ADDITION.

Tyro. How do you prove *Addition?*

Philo. Two Ways. *Firſt*, When you have caſt up any Sum, as before directed, then begin at the Top and caſt downwards inſtead of upwards; and if the Figures come the ſame, no Doubt but the Work is right: Beſides, in Things which require Care, you ſhould make a Practice of caſting every Line, firſt upwards and then downwards.

The *ſecond* Way is very well for Learners, but too tedious for Buſineſs; but as it is cuſtomary in Schools to teach it, I ſhall ſhew you the Method, which is as follows.

Let us take *Queſt.* 4, which amounts to 301 Miles; and to prove whether this be right, I cut off the Top Line of Figures by a Stroke with the Pen, thus——

149
62
21
50
19
301 *Anſ.*
152 Add this to the Top 149.
149 *Proof.* See *Addition of Money.*

Then I begin to caſt the Sum up again as I did at firſt, only inſtead of going to the Top of all, I now, this ſecond Time, caſt no further than the 2, (leaving out all the Figures that are cut off, or that ſtand above the Line) and find it amounts to 12, which is 2, and I carry 1; then I proceed to the ſecond Row, and find it amounts to 15, ſo that this amounts in all to 152, which I place under the 301. *Laſtly,* I add this middle Line 152 to the top Line 149, and find that they make juſt 301, which proves the firſt Work to be right. I ſhall give you a further Reaſon, when you come to Examples of *Money,* why this Way is not ſo fit for Practice in Buſineſs as caſting the Sum upward and downward. And now we will proceed to

SECTION IV.

ADDITION *of* MONEY.

Tyro. WHAT is neceſſary to the Learning of *Addition of Money?*

Philo. Theſe three Things: *Firſt,* the Rule; then the Characters, and *thirdly,* Pence-Tables; all which ſhould be perfectly got by Heart before you pretend to caſt up Money.

1. *The* RULE.

For every 4 Farthings carry 1 Penny to the Pence; for every 12 Pence carry 1 Shilling to the Shillings, and for every 20 in the Shillings carry one to the Pounds, which are caſt up by Tens, as in *whole Numbers*.

2. *Of the Common* CHARACTERS.

Note 1. £. ſtands for Pounds, *S* ſtands for Shillings. *D* ſtands for Pence. Or thus, £. *s.* *d.* Pounds, Shillings, Pence.

Note 2. A Farthing is one fourth Part of a Penny, and is thus ſet down $\frac{1}{4}$. An Half-penny is one Half, and is thus ſet down $\frac{1}{2}$. Three Farthings being three Fourths, is thus ſet down $\frac{3}{4}$.

Note 3. 1 Quarter, 1 Half, and 3 Quarters are alſo ſet thus, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$.

3. *Of* PENCE-TABLES.

TABLE 1.

Pence.		*s.*	*d.*
20		1 –	8
30		2 –	6
40		3 –	4
50		4 –	2
60	is	5 –	0
70		5 –	10
80		6 –	8
90		7 –	6
100		8 –	4
110		9 –	2
120		10 –	0

TABLE 2.

Pence.		*s.*
12		1
24		2
36		3
48		4
60	is	5
72		6
84		7
96		8
108		9
120		10

By the Help of theſe two Tables, the firſt encreaſing by Tens, or every 10 Pence; and the other by even Shillings, or every 12 Pence, you will ſoon caſt up any ſmalls Sums, by a due Regard to the following Examples.

Tyro. But I hope, Sir, you will give me an Example in Length, by explaining it in Words; for that will be of more Service to me than an hundred Examples without Explanation.

EXAMPLE 1.

	£.	s.	d.	
Add	9 -	4 -	2	
	8 -	5 -	3	
and	7 -	9 -	6	together
	24 -	18 -	11	

EXAMPLE 2.

	£.	s.	d.	
add	41 -	3 -	8	
	62 -	9 -	7	
and	47 -	11 -	6	together
	151 -	4 -	9	

EXAMPLE 3.

	£.	s.	d.	
Add	95 -	16 -	2	
	68 -	14 -	10	
and	49 -	12 -	11	together.
			*	

Phil. You ſeem to be timerſome, and doubt your own Abilities without Occaſion. Come, pray try at the firſt Sum?

Tyro. I ſee plainly how you do *that*, becauſe the Pence all added together do not exceed 12, nor the Shillings do not exceed 20; therefore, I ſet the Amount of them under the Row to which they belong, and find the Total to be twenty-four Pounds, eighteen Shillings, and Eleven-Pence.

---

* I leave *Example* 3 undone for your Practice, and will give you another Table for the more eaſily caſting up the Shillings.

Philo. The ſame is to be obſerved in *Ex.* 2. Thus I ſay, 6 and 7 is 13, and 8 is 21 Pence. Now, by the 1ſt *Table*, 20 Pence is 1*s.* 8*d.* therefore, 21 Pence muſt be 1*s.* 9*d.* Or by the 2d *Table*, I aſk how many Times 12 I can have in 21*d.* and find it 1, and 9 over; therefore, I ſet the odd 9 down under the Place of Pence, and carry 1 to the Shillings, ſaying, 1 that I carry and 11 is 12, and 9 is 21, and 3 is 24 Shillings. Now, as 20*s.* make a Pound, 24*s.* is 1*l.* 4*s.* therefore, I ſet the 4 under the Shillings, and carry one to the firſt Row of the Pounds, caſting them up as in *Addition of whole Numbers*, and find it 151*l.* So is the Total 151*l.* 4*s.* 9*d.*

TABLE 3.

Shillings.		Pounds.	*s.*
20		1 -	
30		1 -	10
40		2 -	
50		2 -	10
60	is	3 -	
70		3 -	10
80		4 -	
90		4 -	10
100		5 -	

Pleaſe to add up the following Sums.

EXAMPLE 4.			EXAMPLE 5.			EXAMPLE 6.		
£.	*s.*	*d.*	£.	*s.*	*d.*	£.	*s.*	*d.*
45 -	9 -	9	249 -	3 -	10	652 -	5 -	8
94 -	5 -	8	176 -	5 -	8	652 -	5 -	8
76 -	7 -	10	649 -	8 -	6	652 -	5 -	8
51 -	8 -	9	148 -	7 -	5	652 -	5 -	8
25 -	7 -	6	219 -	5 -	7	652 -	5 -	8
75 -	5 -	11	154 -	7 -	9	652 -	5 -	8
368 -	5 -	5						

Tyro. I begin at the Row of Pence, and find that it amounts to 53. Now, according to my *firſt Pence-Table*, 50 Pence is 4*s.* 2*d.* therefore, 53 Pence is 4*s.* 5*d.* Or by *Table* 2, I find how many 12 Pences I can have in 53 Pence, and find that 4 Shillings is 48 Pence, therefore, 53*d.* muſt be 4*s.* 5*d.* which odd 5 Pence I ſet down under the Row of Pence, and carry the 4 Shillings to the Row of Shillings, and find it amounts to 45. Now, by *Table* 3, I find 45*s.* to be 2*l.* 5*s.* which odd 5*s.* I put under the Shillings, and carry 2*l.* to the Pounds, which I caſt up as in *Whole Numbers* (by Tens) and find the *Total*, or whole Amount, to be 368*l.* 5*s.* 5*d.*

Philo. Very well; but now you have done it, pray let me hear you ſay what it comes to? For I have known many School-Boys not able to read what they write or caſt up.

Tyro. 'Tis very true, Sir, but I think it is three hundred and ſixty Pounds, five Shillings, and five Pence.

Philo. Very right; and I make no doubt by your careful Proceeding, but you will underſtand the firſt four Rules of *Arithmetic* in a ſhort Time I leave *Example* 5 and 6 undone for you, to try at Leiſure, after the ſame Way and Manner: And now I will try you with an Example or two with Farthings.

EXAMPLE 7.			EXAMPLE 8.			EXAMPLE 9.		
£.	*s.*	*d.*	£.	*s.*	*d.*	£.	*s.*	*d.*
47	8	4½	271	7	6¾	278	4	3
15	5	10	146	5	8¼	164	8	9½
17	4	8½	956	8	3	215	1	10
49	9	6¼	178	7	8¾	464	5	4¼
15	10	7	246	9	7¼	176	7	8½
14	7	9¾	101	6	5	291	3	5
97	3	5¾	247	8	3½	456	7	6¾
14	9	6	604	9	8¾	278	5	7

Anſ. 270 - 19 - 9¾

Tyro. I can do theſe as well as the other. *Firſt,* I begin with the Farthings, ſaying, 3 and 3 is 6, and 1 is 7, and 2 is 9, and 2 is 11 Farthings, that is, 2*d.* and 3 Farthings over, which 3 Farthings I ſet under the Row of Farthings (thus ¾) and carry 2 Pence to the Pence, and find they amount to 57 Pence, which is 4*s.* 9*d.* This odd 9 I ſet under the Pence, and carry 4 to the Shillings, and find them 59, that is, 2 Pounds, and 19 over, which 19 I ſet under the Shillings, and carry 2 to the Pounds, I find them come to 270: So is the Total or Anſwer 270*l.* 19*s.* 9*d.* ¾.

Philo. Very well done indeed: Proceed in the ſame Manner, and you will find *Ex.* 8. to be 2752*l.* 3*s.* 3*d.* ¼.

Tyro. I am obliged to you, Sir, and now I ſhould be glad you would give me Inſtructions how you manage *double Figures* in the Shillings.

Philo. I will ſhew you three or four different Ways, and you may take that which appears moſt natural and eaſy.

4. *Of caſting up* double Figures *in the Shillings, ſuch as* 16. 18. 17. *or the like.*

EXAMPLE 10.			EXAMPLE 11.			EXAMPLE 12.		
£.	s.	d.	£.	s.	d.	£.	s.	d.
64	17	10¼	756	17	8	4715	11	10½
47	14	11	175	16	11¼	1762	14	5
67	18	10¾	476	11	9½	6471	14	6¾
55	17	8½	187	17	10	1754	15	11¼
49	19	11	256	19	5¾	6474	19	8
64	15	5	175	14	11¼	1762	17	6
351	04	8½						

METHOD 1. I caſt the Farthings up (firſt upwards and then downwards) and find them 6, I therefore ſet down ½, and carry 1 to the Pence, which are 54, which

is 4*s.* 8*d.* that is, 8 and I carry 4 to the Shillings; but as there are two Rows of Shillings, or *double Figures*, I firſt of all caſt up that Row, or thoſe Figures that ſtand towards the Right-hand, ſaying thus, 4 that I carry and 5 is 9, and 9 is 18, and 7 is 25, and 8 is 33, and 4 is 37, and 7 is 44 the firſt Row; then I come back upon the ſecond Row, from the Top to the Bottom, calling every Figure of 1, Ten; ſaying, 44 and 10 is 54, and 10 is 64, (and ſo on) 74, 84, 94, and 10 is 104 Shillings, which is 5 *l.* and 4 Shillings over, that is 4, and I carry 5 to the Pounds, which I find amount to 351. So that the Total is 351 *l.* 4*s.* 8*d.* ½.

METHOD 2. Some like *this* Way beſt; they caſt up the firſt Row of Shillings, as before, which comes to 44, that is 2*l.* 4*s.* and ſet the 4 Shillings under the ſaid Row, and carry the 2*l.* to the next Row of Shillings, counting 1*l.* for every two Figures in the ſecond Row, (becauſe two Tens make 20*s.* or 1*l.*) Thus in the above Example, there are ſix Figures of 1 in the ſecond Row, and counting two of them for 1*l.* then ſix will be 3*l.* which with the 2*l.* that belonged to the 44 in the firſt Row, make 5*l.* to be carried to the Pounds as before.

METHOD 3. Others make Uſe of *Dots:* That is, they make a Dot at every 4 in the Farthings, every 12 in the Pence, every 20 in the Shillings, and every 10 in the Pounds, which Method is very eaſy, and ſuitable to Lads of a dull Comprehenſion, and bad Memory; becauſe they are not able to carry a large Number of Pence and Shillings in their Mind, but frequently carry falſe from Figure to Figure.

Note, There are different Opinions concerning Pointing, or Dotting: Mr. *Dilworth* highly recommends it; but Mr. *Fiſher* calls it ſlovenly and unneceſſary. It is not my Province to determine between theſe Gentlemen: But this I will ſay, that every Maſter ſhould try all Methods, and let the Scholar uſe *that* which is moſt natural and eaſy to his Capacity. He muſt be very dull who can't tell that 2 Tens make 20, or that 13

Twenties make 260: And to ſtop or point at ſo ſmall Numbers, as 3, 4, 5, 6, *&c.* ought (if poſſible) to be avoided; becauſe to add up well, and learn to caſt out quick, is a great Step towards *Multiplication*, and it would look very odd to ſee a Perſon (after having done a long Sum in that Rule) dot every Ten in caſting up the Product. I think therefore, there is no Occaſion to point or dot at every 4, 10, 12, or at even Twenties, when a little Practice will make it eaſy: But indeed when you come to do by 13, 16, 19, 28, or the like, there Dotting muſt unavoidably be uſed, as you will ſee in the firſt Example of *Averdupoiſe Weight*, wrought at large.

N. B. *If you are obliged to dot, mind and make them very ſmall; if you can ſee them yourſelf, that is ſufficient: But the firſt Method, in my Opinion, is beſt, except it be a very long Sum, ſuch as the Side of a large Book, a* Bill, *or a* Pariſh Rate, *or* Duplicate, *and then the following Method is the moſt certain and expeditious, and is very eaſy.*

METHOD 4. *Of making and caſting up long Bills*, PARISH RATES, *&c.*

Tyro. How is the general Way of caſting up very long Bills, Rates, *&c.*

Philo. The Rule is this: *For every* 60 *in the Pence carry* 5 *to the Shillings*, becauſe 60 Pence make 5 Shillings: And *for every* 60 *in the Shillings carry* 3 *to the Pounds*, becauſe 60 Shillings make 3 Pounds; and *laſtly, caſt the Pounds up by Tens, as before directed.*

Tyro. Pleaſe to give me an Example at large.

Philo. I will ſhew you firſt, how to make a *Pariſh Rate*, which may be of Service, and if you can caſt it up well, you may alſo caſt up any long Bill, by the ſame Rule.

The Form of a PARISH RATE, *&c.*

	£.	s.	d.
Allen Anthony, *Eſq*;	3	7	8 ¼
Andrews John	1	14	7 ½
Baker James, *Eſq*;	15	16	8
Carter Thomas		17.	11 ½
Darby Abraham	5	17	5
Fernell Abraham		19	8 ¾
Honner Joſeph	7		9.
Kirton John, *Eſq*;	21	14.	7 ¼
Longman Thomas	5		11 ½
Lumley Edward	3	17	6
Manning Thomas		15	10 ¼
Martin William, *Eſq*;	11	11	8 ½
Martin Job	7	17.	8
Nicholls Abraham	2	13	9
Norton Daniel, *Eſq*;	17	10	4. ½
Parker Eſther		8	11
Powell Judith		5	10
Randall Nicholas	1	17	6 ½
Robinſon Abraham, *Eſq*;	15	11.	11 ½
Robinſon John	7	10	
Robinſon James	1		10
Ruggles Nathaniel	7	11	4
Rumley Thomas		15	½
Solly Thomas, *Eſq*;	12	11	
Sorſby William		14.	
Spratly David	8		11.
Swallow Thomas	1	17	4
Thompſon John		19	11 ¾
Twiſt William, *Eſq*;	7	7	
Walker John	1	15.	6
Wayland Edward, *Eſq*;	8	14	9 ½
Wingate Samuel		15	7
Worley Abraham, *Eſq*;	5	4	10
	£. 189	19	7 ¾

Firſt, I begin with the Row of Farthings (as in the former Queſtions) and find them amount to 27, which is 6 Pence, and 3 Farthings over; which 3 I ſet under the Farthings thus (¾) and carry 6 to the Pence.

Secondly, For the PENCE.

I ſay 6 that I carry and 10 is 16, and 7 is 23, and 9 is 32, and 6 is 38, and 11 is 49, and 4 is 53, and 11 is 64; this being 4 above 60, I make a ſmall Dot cloſe to the 11, and carry the 4 that is over to the next Figure, ſaying 4 that I carry and 4 is 8, and 10 is 18, and 11 is 29, and 6 is 35, and 10 is 45, and 11 is 56, and 4 is juſt 60; therefore, as there is Nothing over to carry to the next Figure, I ſay 9 and 8 is 17, and 8 is 25, and 10 is 35, and 6 is 41, and 11 is 52, and 7 is 59, and 9 is 68; that is 8 above 60, therefore I make a Dot, and carry 8 to the next Figure, ſaying, 8 and 8 is 16, and 5 is 21, and 11 is 32, and 8 is 40, and 7 is 47, and 8 is 55: Now 50 Pence is 4*s.* 2*d.* therefore 55 Pence is 4*s.* 7*d.* which odd 7 Pence I ſet under the Pence, and carry the 4 Shillings to the Dots, counting (as I ſaid before) 5 Shillings for every Dot, which are three in Number, that is, 15 Shillings; and the 4 I carried to them is 19 Shillings: This 19 I carry to the Shillings, and contrary to the other Methods, I now work Croſs-ways, taking the *double Figures* as I go along, *viz.* the Right-hand Figure firſt, and then the Left-hand one belonging to it, counting it for 10, as follows.

Thirdly, For the SHILLINGS.

I ſay 19 that I carry and 4 is 23, and 5 is 28, and the 1 on the Left-hand of it, which is always counted for 10, is 38, and 4 is 42, and 10 on the Left-hand belonging to it, is 52, and 5 is 57, and the 10 belonging is 67: Here, according to the ſame Rule, I make a Dot, and carry the odd 7 to the next Figure, as I did in the Pence; ſaying, 7 that I carry and 7 is 14, and 9 is 23,

and

and 10 is 33, and 7 is 40, and 10 is 50, and 4 is 54, and 10 is 64; that is, Dot, and I carry 4, to 11 is 15, and 5 is 20, and 10 joining it is 30, and 11 is 41, and 10 is 51, and 11 is 62, which is Dot, and I carry 2 to the next Figure, proceeding in the ſame Manner, as before directed, till I come to the Top of all, and find there are 39 Shillings, beſides the laſt Dot, that is, 1 £. 19 *s.* therefore, I ſet the 19 under the Shillings, and carry the odd 1 £. to the Dots (counting 3 £. for every Dot, becauſe 60 Shillings is 3 £.) and find them 6, which is 18 £. and 1 I carried to them is 19 £. which I carry to the firſt Row of the Pounds, caſting them up by Tens, as in *whole Numbers*, and find them 189 £. So that the Total of the Rate, or Bill, is 189 £. 19 *s.* 7 *d.* ¾. Pray, *Tyro*, run it over once more, and the Method alſo, and you will not loſe your Labour.

Tyro. Sir, I ſee the Nature of it very well; but why do you leave thoſe Vacancies in the Shillings and Pence, for moſt People fill them up with Cyphers.

Philo. I know it is the common Cuſtom of Schools, but it is a very idle one, nor is it ſo ſightly or convenient; for the Cyphers hinder Sight, and prevent Expedition in caſting up. *See Example 6, in whole Numbers.*

5. *Of* CYPHERS, *where neceſſary, and where not.*

EXAMPLE 13, *without Cyphers, according to the true Order of* BOOK-KEEPING.

£.	*s.*	*d.*
5478	9	6
1	19	5
	6	8¾
179		
	17	½
7	5	9
1	17	7
	4	½
5670		¾

EXAMPLE 13, *with Cyphers, according to the common Cuſtom of Schools.*

£.	*s.*	*d.*
5478	09	06
0001	19	05
0000	06	08¾
0179	00	00
0000	17	00½
0007	05	09
0001	17	07
0000	04	00½
5670	00	00¾

Now, *Tyro*, I would aſk you which is moſt ſightly, *that* which ſtands clear, or the other confuſed with Cyphers. And it is not only this, but every Line of the Sum, and the Total alſo, reads much better: For it is only five Thouſand, ſix Hundred, and twenty Pounds, and three Farthings; whereas the other, according to the Manner of Cyphers (and the too common Cuſtom of School-boys) muſt be thus read, *five Thouſand, ſix Hundred, and ſeventy Pounds, no Shillings, and no Pence, three Farthings*. And tho' Cuſtom ſome Years ago prevailed upon one of the moſt ingenious Authors[*], to uſe the *Expreſſion* after this Sort; yet it does not at all juſtify the Correctors of the laſt Edition, ſince it is now quite ſuperfluous, and out of Date.

Note, Though I ſay it be not cuſtomary to uſe Cyphers, in *Addition of Money*, yet, in *Weights* and *Meaſures* they are often made Uſe of, and the Learner may take his own Fancy, that teaches himſelf; but it is my Opinion that Maſters in general would find it much eaſier and better, both to themſelves and Scholars, to ſet their *Addition* Sums quite clear, and uſe no Cyphers at all before Figures.

Tyro. I am obliged to you, Sir; and now, if you pleaſe, I would know how you prove *Addition?*

Philo. That is quite eaſy, *Tyro*.

6. *To prove* ADDITION *of* MONEY.

There are two Ways, one by cutting off the top Line (of which ſee under the Proof of *Addition*,) but it is not practicable in Buſineſs, the beſt Way is this: Begin at the Bottom and caſt up to the Top, noting down what it comes to; then begin at the Top, and caſt the ſame Row downwards, and if it amounts to the ſame as before, there is no Doubt but the Work is right, provided you obſerve carefully to ſet it down right.

---

[*] *Wingate*, Page 8.

SECTION V.

Containing ſome farther Explanation of Things neceſſary to be known, with the Manner of drawing out Bills, *writing* Notes, *and* Receipts, *&c. being very proper to exerciſe the young Beginner.*

Tyro. I Shall be at a Loſs under this Section.

Philo. You are miſtaken; for I ſhall not leave you to yourſelf wholly, but will explain every Thing I am capable of, to your Underſtanding; becauſe I am ſenſible many School-boys can add up Sums that are ſet them very well; but when they are called upon out of School, to write out, and caſt up a ſmall Bill, or the like, how awkward do they go about it, and will ſet puzzling over it ſo long, that one would think they knew Nothing at all of the Matter: And when it is done, it is often ſet in ſuch Confuſion, that it will puzzle much better Scholars than themſelves to caſt it up; becauſe they do not obſerve to place their Figures right under one another, which beſure, *Tyro,* you be always careful of, for it is a great Advantage, and the Work will look neat, and you will have the Praiſe.

Tyro. 'Tis very true, Sir, I have known ſeveral that could caſt up a Bill if others would figure it down, but have not had any Notion of drawing it out themſelves: Nor can I ſay I have, and therefore ſhould be obliged to you to ſhew me.

Philo. That I will; but firſt of all, it will be proper to ſhew you ſome *Contractions* made Uſe of both in Books and Bills.

1. *Of contracted Words, and what they ſignify.*

Note 1. *Bt.* ſtands for, or ſignifies *Bought.*

2. *Dr.* is *Debtor.* *Cr.* is *Creditor.*

3. *Do.* ſtands for *Ditto,* and ſignifies the ſame Thing, Place, or Sort of Goods, as was wrote in the Line before;

fore; it is uſed by Merchants, Tradeſmen, and Accomptants, both in Books and Bills, to avoid writing the ſame Thing over and over again.

4. *Co.* ſignifies *Company*; that is, when two or more are in Trade and in Partnerſhip.

5. *Meſſrs.* ſignifies *Meſſieurs*, or Gentlemen concerned together in ſome Trade or Buſineſs, and is uſed with the foregoing Contraction, (*Co.*) on the Head or Front of the Bills, inſtead of writing all their Names at Length: Thus, Suppoſe *John Sharp* to have a Bill upon *Aaron Nelſon*, *John Long*, and *Joſeph Truman*, it would be ridiculous to write thus:

Mr. *Aaron Nelſon*, Mr. *John Long*, and Mr. *Joſeph Truman*, bought of *John Sharp*.—— But we write thus:

Meſſrs. *Aaron Nelſon*, and *Co.* Bt. of *John Sharp*, as you will ſee in the following Example.

A Linnen-Draper's BILL.

EXAMPLE I.

Meſſrs. *Aaron Nelſon*, and *Co.* Bt. of *John Sharp*.

1753			£.	s.	d.
Jan.	4	To 11 Pieces of *Iriſh*, at 3 *l. per* Piece. —— ——	33	–	–
	12	To 2 Ditto, at Do. ——	6	–	
Feb.	8	To Long Lawn, as by Agreement.	3	15	6
Apr.	12	To 2 Pieces of Check, as by Do.	1	7	10
	28	To 4 Do. as by Do. ——	2	2	–
May	24	To 2 Yards of Dowlas, at 11 *d.*	–	1	10
Aug.	9	To a Parcel, as *per* Bill ——	1	15	6
This Bill I caſt up as a common Sum in *Addition of Money*, and find the Total			48	2	8

EXAMPLE 2.

A Stationer's BILL.

Mr. *Samuel Long* Bt. of *John Page.*

1753		£.	s.	d.
May 19	2 Ream of Fool's Cap ſuperfine Paper	1	10	
June 12	4 Ditto	3		
	20 Ream of coarſe Brown	1	10	6
Aug. 14	To ſundry Goods, as *per* Bill	3	19	6
		£. 10		

Note, Some Perſons never uſe the Word *To* at the Beginning of the Bill. *Note* farther, the Word *To* is uſed in Books of Accompts on the *Dr.* or Left-hand Side. The Word *By* is uſed on the *Cr.* or Right-hand Side.

And now, *Tyro,* I ſhall draw you out a few more Bills, and leave you to ſet them on a Slate, and caſt them up yourſelf, which will be of Service, by Way of Exerciſe.

EXAMPLE 3.

A Goldſmith's BILL.

Mr. *James Proud* Bt. of *Paul Fineſhew.*

1753				
May 9	To 1 Diamond Ring	15		
	2 Pair of Silver Salts	2	2	6
	1 Quart Tankard	10	10	
	1 Pint Do.	4	7	6
	1 Dozen of Knives and Forks	3	2	6
	1 Silver Tea-Kettle	5	5	
	12 Tea-Spoons, Tongs, and Cream-pot	1	15	
	Total £.			

EXAMPLE 4.

A Taylor's BILL.

Mr. *Robert Patience* Dr. to *John Trimmer*.

		£.	s.	d.
1753 *Mar.* 15	To 2 Yards of Cloth, at 18*s. per* Yard	1	16	–
	Making your Coat	–	8	–
	4 Yards and a Half of Shalloon, at 2*s.*	–	9	–
	Buckram, Staytape, and Canvas	–	3	6
	Silk, Twiſt, and Mohair	–	2	8
	Making a Suit for your Son	–	15	9
	Buckram, Silk, Twiſt, Mohair, &*c.*	–	4	3
	Buttons to the ſame	–	3	6
		£.		

Now, from theſe four Examples, *Tyro*, you may form any other Tradeſman's Bill in due Order; and as for making out or balancing any Reckoning, between one Perſon and another, to ſee how much is due to either, is not the Work of *Addition*; but I ſhall explain it very fully to you in *Subtraction*.

2. *The Manner, or common Form of* Receipts, *and* Notes of Hand.

Tyro. How am I to give, or write a *Receipt?*

Philo. According to what Money you receive, and the Perſons you receive it of, or for. Let us take the Stationer's Bill in *Example* 2, which is 10*l*. Now, if he receives it in full, the Receipt will run thus:

Auguſt 6, 1753. *Received of Mr.* Samuel Long *Ten Pounds, in full of all Demand.*

John Page.

£. 10.

If the Receipt be wrote upon the Bill itſelf, then this is better:

Received at the ſame Time the Contents in full.

John Page.

EXAMPLE 2. If only Part be received, then thus:

Auguſt 16, 1753. *Received of Mr.* Samuel Long *Five Pounds, on Accompt.*

John Page.

£. 5

EXAMPLE 3. If the Perſon that receives the Money be a Son or Servant, he muſt write thus:

Auguſt 16, 1753. *Received of Mr.* Samuel Long *Ten Pounds in full, for my Father (or Maſter.)*

John Page, *jun.*

EXAMPLE 4. For Rent.

June 14, 1753. *Received of Mr.* John Lumley *twelve Pounds, ten Shillings, for Half a Year's Rent, due at* Lady-Day *laſt.*

Abraham Gripe.

£. 12 – 10

EXAMPLE 5. When there has been an Account of long ſtanding, and at laſt the two Parties agree to have a Reckoning, but ſtill he that owes Money upon the Balance has none at that Time to pay, then the following Form is counted better than a common Note of Hand, becauſe it ſhews the Reaſon of ſuch an Acknowledgment: But then this Writing ſhould be drawn in the Book of the Perſon to whom the Balance is due, and if ſigned in the Preſence of Witneſſes the better. The Form is thus:

Auguſt 16, 1753. *Reckoned and balanced all Accompts, and I* Samuel Long *acknowledge myſelf to be indebted to* John Page *three Pounds, ten Shillings, which I promiſe to pay on Demand, for Value received. Witneſs my Hand,*

Teſt. Samuel Long.
Abraham Juſtice.

EXAMPLE 6. When a Perſon has no Money about him, or has his Money in other Perſons Hands, and gives you a Note or Draught upon them for the Payment of any Sum, it is wrote after this Manner:

Sir, Pleaſe to pay to Mr. John Page, *or Bearer, three Pounds, ten Shillings, and place it to the Accompt of*
Your humble Servant,
To Mr. Jonathan Truſty. Samuel Long.

3. *Of the Value of the common Coins uſed in* England, *how they are expreſſed, and how ſet down.*

A *Port*, or *Portugal* Piece, is ſet down 1 *l.* 16 *s.* but is expreſſed, or commonly called a Six and Thirty.

A double *Port* is 3 *l.* 12 *s.*

A *Moidore* is ſet down 1 *l.* 7 *s.* but called a Seven and Twenty.

A *Guinea* is 1 *l.* 1 *s.* and expreſſed a Guinea.

A *Crown* is expreſſed a Crown; but ſet down 5 *s.*

Half a Crown is 2 *s.* 6 *d.*

A *Teſter* is Six-pence.

A *Groat* is Four-pence.

An uſeful EXAMPLE.

A Servant laid out Caſh as follows: For *Coals* a Guinea and a Half. *Cloth* Three and Twenty and Six-pence. *Meat* ſeven Groats. *Butter*, *Eggs*, and *Bacon* Nineteen-pence Halfpenny, and *Thread* ſeven Farthings. What was laid out in all?

Tyro. I ſet them down as follows.

	£.	s.	d.
For Coals	1	11	6
Cloth	1	3	6
Meat		2	4
Butter, Eggs, and Bacon		1	7½
Thread			1¾
In all	2	19	1¼

Philo. Very well done indeed. *Obſerve further then,* that from *one* to *two* Shillings, and from *one* to *two* Pounds, the *Expreſſion* is different from the *Setting-down.* Thus, 1 *s.* 10 *d.* ½ is expreſſed Two and Twenty-pence Halfpenny; and 1 *l.* 19 *s.* 6 *d.* is expreſſed Nine and Thirty and Six-pence.

So alſo, though theſe Numbers, 1300, 1753, and 2500, are properly, one Thouſand three Hundred, one Thouſand, ſeven Hundred, and Fifty-three, and two Thouſand, five Hundred; yet they are thus expreſſed; thirteen Hundred, ſeventeen Hundred and Fifty-three, and Five and Twenty Hundred.

Tyro. I heartily thank you, kind Sir, and if it were not too troubleſome, I could wiſh you would ſet me a few Queſtions by Way of Exerciſe.

Philo. You do very well to aſk me, *Tyro*; but it will be better at the End of *Addition,* where I ſhall give you ſome uſeful Examples.

SECTION V.

AVOIRDUPOIS WEIGHT.

Tyro. PRAY what is the Uſe of this Rule, or what is weighed by it?

Philo. Moſt Things that are commonly dealt in, ſuch as *Grocery-Wares,* and alſo, *Cheeſe, Butter, Soap, Candles,*

Candles, *Allom*, *Braſs*, *Iron*, *Copper*, *Salt*, *Hemp*, and all ſuch Sort of Goods.

Tyro. What are the different Names or Denominations of the Weights uſed in this Rule.

Philo. The *greateſt* Denomination is a *Ton*, and the *leaſt* a *Dram*. They run thus in Order: *Tons*, *Hundreds*, *Quarters*, *Pounds*, *Ounces*, and *Drams*; of which is compoſed the following Table, with the Characters that ſtand for each Denomination after them.

The TABLE.

16 Drams	make	1 Ounce, marked thus,	*oz.*
16 Ounces		1 Pound	*lb.*
28 Pounds		1 Quarter of an Hundred	*qr.*
4 Quarters		1 Hundred Weight	*Ct.*
20 Hundreds		1 Ton	*T.*

Tyro. Should I get this Table by Heart?

Philo. You may do as you pleaſe: I know ſome Maſters call it unneceſſary; but if you take my Advice, learn every Table perfectly. 'Tis true, you may do the Sums without it, if you have the Table before you, but it would be a very bad Thing to make an Excuſe, by ſaying, you could do ſuch a Sum if you knew the Rule by Heart; and I have known many a Lad lament the Omiſſion.

Tyro. I don't doubt it at all, and I will take your Advice: Pleaſe to tell me how you caſt up thoſe Sums.

Philo. The ſame as in *Addition of Money*, only you ſtop (as is plain by the Table) by different Figures; and for your further Information, I ſhall put over every Row and Denomination, the Quantity you are to ſtop at, or do by, and ſhall give you one Example at large as a ſtanding Rule for all that follows.

EXAMPLE 1.

(10) *Tons*	(20) *C.*	(4) *qrs.*	(28) *lb.*
25	14	1	25.
18	11	2	16
27	17	3	21.
46	14	1	17.
16	17	2	15
45	15	1	17.
16	17	3	14
198	9	1	3

EXAMPLE 2.

(10) *C.*	(4) *qrs.*	(28) *lb.*	(16) *oz.*
42	1	17	10
17	2	19	14
21	3	22	11
17	2	17	12
24	1	22	15
65	3	17	13
24	1	21	10

I begin at the *lbs.* and ſay, 14 and 7 is 21, and the 1 on the Left-hand (which is always called 10) is 31; that is, 3 above 28; therefore, I make a Dot againſt the 7, and carry the odd 3 forward; ſaying, 3 that I carry and 5 is 8, and 10 on the Left of it is 18, and 7 is 25, and 10 on the Left is 35, that is, 7 above 28; then I dot again, and carry 7 to the next Figure, ſaying, 7 and 1 is 8, and the 2 on the Left-hand, which ſtands for 20, is 28; therefore, as there is nothing over, I only ſay 16 and 5 is 21, and 10 is 31, that is, 3 above 28, which 3 I place under the Row of Pounds, and then telling my Dots, I find them 4 (that is 4 qrs.) which I carry to the next Row of qrs. ſaying, 4 and 3 is 7, and 1 is 8, and 2 is 10, and 1 is 11, and 3 is 14, and 2 is 16, and 1 is 17 Quarters. Now as 4 Quarters make an Hundred, I aſk how many *Fours* I can have in 17, and find 4 *Fours*, and 1 over, that is, 4 Hundred, 1 Quarter, which 1 I place under the Row of Quarters, and carry the 4 to the Hundreds, which I caſt up by *Twenty*, the ſame as in *Addition of Money*, ſaying, 4 that I carry and 7 is 11, and 5 is 16, and 7 is 23, and 4 is 27, and 7 is 34, and 1 is 35, and 4 is 39; then I come back with the Tens, ſaying, 39 and 10 is 49, and 10 is 59, and ſo on, 69, 79, 89, 99, and 10 is 109, which is 5 Twenties, and

9

9 over; that is, 5 Tons, and 9 Hundred over, which 9 I place under the Hundreds, and carry 5 to the firſt Row of the Tons, and caſting them up as Whole Numbers by Tens, I find the firſt Row 48, that is, 8, and I carry 4 to the next Row, which amounts to 19. Therefore the Total is 198 *Tons*, 9 *C.* 1 *qr.* 3 *lb.*

☞ This is a ſtanding Rule, *Tyro*, for all your other Sums in *Addition*, which are caſt up after the very ſame Manner: Thoſe that you find done are for your Information and Satisfaction; and ſuch as are left undone are for your Practice. Are you ſatisfied with what I have told you?

Tyro. Sir, I am; but in *Example* 2, I perceive you ſet 10 over the *Hundreds* Place, contrary to the Table; whereas in *Example* 1, you have ſet 20 over the *Hundreds* Place, which I own puzzles me at preſent.

Philo. That is for Want of a little Conſideration, *Tyro*: For whatever *Name* or *Denomination* ſtands firſt (that is, whatever you add up laſt) is always added up like *Whole Numbers*, by *Tens*; be they *Tons*, *Hundreds*, *Pounds*, *Shillings*, *Yards*, *Ells*, or any Thing elſe, as you will ſee hereafter.

Tyro. I am obliged to you, Sir, and deſire no further Inſtruction in *Addition*, but only the Rules and Examples to go by.

Philo. You ſhall not want for either, and they are all done after the ſame Manner as this Example before you, though by different Figures: And pray take *Notice*, all thoſe Examples that you find ready done, are not to indulge you in Idleneſs; but the Anſwers are inſerted for your Information and Satisfaction; and thoſe that are left undone are for your Exerciſe, Practice, and Improvement; and though I told you in *Addition of Money* it is not cuſtomary to uſe Cyphers; yet, if you chuſe it, take your own Way; but you will find it better to leave them out, when there is no Occaſion to uſe them.

AVOIRDUPOIS *Small Weight.*

Tyro. What is the Uſe of this Rule?

Philo. It is chiefly uſed by ſuch as deal in Silk, Worſted, Thread, *&c.* by *Retail*, or in ſmall Quantities only; that is, from a Dram to Pounds, 16 Drams make an Ounce, and 16 Ounces 1 Pound.

EXAMPLE 1.

(10)	(16)	(16)
lb.	*oz.*	*d.*
2	10	5
4	7	3
1	6	11
6	9	0
3	7	9
18	8	12

EXAMPLE 2.

(10)	(16)	(4)
lb.	*oz.*	*qrs.*
3	14	2
1	11	1
3	9	0
2	01	2
1	00	3

Note, Worſted is weighed by Ounces and Quarters, as in *Example* 2, and no Drams are uſed here, nor in retailing many other Commodities.

Of WOOL,

Wool is weighed by the *Clove*, *Stone*, *Tod*, *Wey*, &c. as follows.

7 Pounds make 1 Clove
2 Cloves, or 14 *lb.* 1 Stone
2 Stone, or 28 *lb.* 1 Tod
6 ½ Tod 1 Wey
2 Weys 1 Sack
12 Sacks 1 Laſt.

Note, In ſome Places 7 Tod are allowed to 1 Wey, and 12 Score, or 240 *lb.* is called a *Pack of Wool*.

Note farther.

A *Firkin* of Soap is 64 *lb.*
A *Firkin* of Butter 56 *lb.*
A *Clove* of Cheeſe 8 *lb.*
A *Wey* of Cheeſe in *Eſſex* is 32 Cloves, or 256 *lb.*
A *Wey* in ſome Parts of *Suffolk* is the ſame; but in other Parts of it, 42 Cloves, or 336 *lb.* make a Wey.

☞ *See* another Table of *Weights* and *Meaſures*, *Section* 6.

TROY-WEIGHT.

Tyro. Of what Uſe is *Troy-Weight?*

Philo. By this is weighed Gold, Silver, Jewels, Electuaries, *&c.* and Liquors in general.

TABLE.

Note,	24 Grains	make	1 Penny-wt.	*dw.* thus.
	20 Penny-wts.		1 Ounce.	*oz.*
	12 Ounces		1 *lb. Troy.*	*lb.*

Note 1. You need not *point* or *dot* at any Row except the firſt, where you do by 24; the others are eaſy and common, as before, the Penny-weights being caſt up by 20, are done the ſame as Shillings; and the Ounces being done by 12, are caſt up like Pence, in *Addition of Money.*

(10)	(12)	(20)	(24)		(10)	(12)	(20)	(24)
lb.	*oz.*	*dw.*	*gr.*		*lb.*	*oz.*	*dw.*	*gr.*
42	11	14	18.		647	11	17	16
26	9	10	21		196	10	15	23
49	10	11	11.		494	11	19	14
65	8	14	12		165	9	15	21
73	9	15	16.		219	1	11	19
87	11	18	11		648	8	15	21
347	2	5	17					

Note 2. That 1*lb. Avoirdupois-Weight* is equal to about 14 Ounces 12 Penny-weights *Troy*.

Note 3. Cuſtom only introduced *Avoirdupois Weight*, and *Beer-Meaſure:* For, according to the Statue Laws, there ſhould be but one *Weight* and one *Meaſure* throughout the whole Realm, as you may ſee under *Dry-Meaſure*, *Note* 1. Therefore, it is evident, that from theſe two different Weights, came the different Sorts of Meaſures, as you will more plainly ſee under *Dry-Meaſure* and *Liquid-Meaſure*.

Note farther the Value of Gold *and* Silver.

Gold.	£.	*s.*	*d.*
That 1 Pound Weight of Gold is worth	48	0	0
1 Ounce	4	0	0
1 Penny-weight	0	4	0
1 Grain	0	0	2

Silver.	£.	*s.*	*d.*
That 1 Pound Weight of Silver is worth	3	0	0
1 Ounce	0	5	0
1 Penny-weight	0	0	3
1 Grain about ½ a Farthing.			

APOTHECARIES WEIGHT.

Tyro. What is the Uſe of this Weight?

Philo. By it *Apothecaries* mix and compound their Medicines, their Pound being the ſame as the Pound *Troy*, only differently divided, as you ſee in the following *Table.*

Note, Though *Apothecaries* mix their Medicines by this Rule, they buy and ſell their Drugs by *Avoirdupois-Weight.*

The TABLE.

20 Grains	make	1 Scruple	℈ thus marked.
3 Scruples	make	1 Dram	ʒ
8 Drams	make	1 Ounce	℥
12 Ounces	make	1 Pound	℔

(10) ℔	(12) ℥	(8) ʒ	(3) ℈	(20) gr.	(10) ʒ	(3) ℈	(20) gr.
42	10	7	2	19	18	1	14
17	8	5	2	11	12	2	17
43	7	6	1	10	41	1	10
15	4	5	1	9	24	2	15
47	11	3	1	8	16	1	11
64	9	6	2	15	17	2	15
232	5	4	0	12			

DRY MEASURE.

Tyro. What is the Uſe of *Dry Meaſure?*

Philo. By this Rule is meaſured all dry Goods, ſuch as Coals, Sand, Salt, Fruit, Oyſters, Wheat, Barley, Peas, and other Grain, as appears by the two following Tables.

TABLE I.

2 Pints	make	1 Quart
2 Quarts	make	1 Pottle
2 Pottles, or 8 Pints	make	1 Gallon
2 Gallons, or 16 Pints	make	1 Peck
4 Pecks	make	1 Buſhel
4 Buſhels	make	1 Coomb
2 Coomb, or 8 Buſhels	make	1 Seam, or Quarter
5 Quarters, or 40 Buſhels	make	1 Load

TABLE

TABLE 2. *For Coals.*

4 Pecks	make	1 Buſhel
9 Buſhels		1 Quarter of a Chaldron
4 Quarters, or 36 Buſhels		1 Chaldron
Note, 5 Pecks		1 Buſhel, Water-Meaſure

Note 1. That 33 *Cubic* Inches, and 3 Fifths, make a *Corn* Pint, 268 Inches, and 4 Fifths, a *Corn* Gallon, and 2150 Inches, 2 Fifths, a true *Wincheſter* Buſhel, according to Act of Parliament, made in 1697, which ſays, That every round Buſhel with an even Bottom, that is, 18 Inches wide, and 8 Inches deep, ſhall be deemed a true legal *Wincheſter Buſhel*.

(10) *Loads*	(5) *qrs.*	(8) *B.*	(4) *Pecks*
24	4	7	3
19	3	5	2
49	2	3	1
47	3	1	2
56	1	5	3
17	3	4	2
215	4	4	1

(10) *Chal.*	(4) *qrs.*	(9) *Buſh.*
64	2	8
17	1	6
48	2	3
17	1	4
96	2	5
17	3	7

(10) *Chal.*	(36) *B.*	(4) *Pecks*
47	31	2
19	17	1
47	16	2
56	14	1
17	13	2
47	27	3

Note 2. The common received Contents of a *Corn* Gallon is 272 Inches. For *Dry Meaſure* is a Mean, as it were, between *Wine* and *Beer* Meaſure. For as 12 *oz. Troy* is to 224 Inches; ſo is $14\frac{12}{20}$ *oz.* to 272 Inches nearly. *See Note* 3, in *Wine Meaſure*.

Note 3. That *Salt*, *Sea-Coal*, and many other Commodities, are heaped in the Meaſuring in general; and where they are not, it is cuſtomary to allow 5 ſtruck Pecks to the Buſhel. *Bran* is double Meaſure; that is, 2 Pecks ſtruck are allowed for one Peck.

Obſerve farther.

A Score of Coals —— ——— is	21 Chaldron, that
is, thoſe that buy 20 Chaldron have	21 for 20
A Sack of Coals —— ——	3 Buſhels
A Sack of Corn in common ——	4 Buſhels
A Sack of Flour — — ——	5 Buſhels
A Load, called a Market Load —	5 Buſhels
A Load in general means — —	40 Buſhels
A Wey is 10 Quarters, or 2 Loads	80 Buſhels
A Laſt in ſome Places is 12 Wey, *viz.*	960 Buſhels

See *Section* 6, in *Addition.*

LIQUID-MEASURE.

Tyro. What is the Uſe of this *Meaſure?*

Philo. All Sorts of Wine, ſpirituous Liquors, and Beer and Ale are meaſured by it, under the Names of *Wine-Meaſure*, and *Wincheſter-Meaſure.*

1. *Of* WINE-MEASURE.

TABLE.

2 Pints	make	1 Quart
4 Quarts		1 Gallon
10 Gallons		1 Anchor of Brandy, or Rum
18 Gallons		1 Runlet
31 ½ Gallons		1 Barrel of Wine or Vinegar
42 Gallons		1 Tierce
63 Gallons		1 Hogſhead
2 Hhds. or 126 Gallons		1 Butt, or Pipe
2 Pipes, or 252 Gallons		1 Tun

Note 1. A *Puncheon* is 8 Anchors, or 80 Gallons; but any Caſk between a *Hogſhead* and a *Pipe*, is called a *Puncheon.*

(10) *Tuns*	(2) *Pipes*	(2) *Hhds.*	(63) *Gall.*
47	1	1	21.
49	0	1	57
64	1	0	16.
45	1	1	18
27	0	0	15
56	1	1	17
291	1	0	18

(10) *Hhds.*	(63) *Gall.*	(8) *Pints*
47	19	7
26	14	1
94	17	5
57	47	6
19	14	4
45	49	5

Note 2. *Cyder*, *Perry*, *Oil*, *Vinegar*, &c. are bought and ſold by this Meaſure; and Milk is alſo ſold in the City of *London* by it; there being no Standard to the contrary, corrupt Cuſtom has reduced the largeſt of liquid Pints to one Half its proper Quantity.

Note 3. The *Wine-Pint* (according to Cuſtom) is reckoned to contain 28 *Cubic* Inches, and 7 Eighths; and the *Gallon* 231 Inches. But by an Experiment made at *Guild-Hall*, in *London*, (1688) a Veſſel containing but 224 *Cubic* Inches, was filled with Water, and carefully emptied into the *Wine Gallon* kept there, which did exactly fill it. But notwithſtanding *this*, it was thought proper to continue 231 Inches to the Gallon, which remains to this Day. And from this Increaſe of the *Wine Gallon* (anſwering to *Troy-Weight*) came the Increaſe of the *Beer Gallon*, which anſwers to *Avoirdupois-Weight*. See *Note* 1, in *Wincheſter-Meaſure*.

2. WINCHESTER-MEASURE.

Tyro. What are the different Meaſures and Denominations for *Beer* and *Ale?*

Philo. They are as under.

TABLE.

2 Pints	make	1 Quart
4 Quarts		1 Gallon
9 Gallons		1 Firkin
2 Firkins, or 18 Gallons		1 Kilderkin
2 Kilderkins, or 36 Gallons		1 Barrel
1 ½ Barrel, or 54 Gallons		1 Hogſhead
2 Hhds, or 3 Bar. or 108 Gall.		1 Butt
2 Butts, or 216 Gallons		1 Tun

Note 1. That 35 *Cubic* Inches 1 Quarter make a *Beer* Pint, and 282 (nearly) 1 Gallon, which anſwers to *Avoirdupois-Weight*. For as 12, the Ounces in 1 *lb. Troy*, is 231, the Inches in a *Wine* Gallon; ſo is $14\frac{12}{20}$ Ounces to 282, the Inches in a cuſtomary *Beer* Gallon. See *Note* 2, *Troy-Weight*.

(10) *Butts*	(2) *Hhds.*	($1\frac{1}{2}$) *Bar.*	(2) *Kild.*	(2) *Firk.*	(9) *Gall.*
15	1	0	1	1	5
23	0	1	0	1	2
41	1	1	1	1	3
22	1	0	1	0	2
7	1	1	0	1	5
1	0	1	1	0	4
113	0	1	1	0	3

(10) *Butts*	(3) *Bar.*	(36) *Gall.*
64	1	27
15	2	18
21	1	14
25	0	15
62	1	16
5	0	29

Note 2. That in gauging *Beer* and *Ale* in *London*, 32 Gallons is a Barrel of *Ale*, and 36 a Gallon of *Beer*; but in other Places 34 Gallons is a Barrel, one with another, and *Common Brewers* in the Country allow Victuallers 36 *Gallons* of both Sorts to the Barrel.

CLOTH-MEASURE.

Tyro. What are the *Denominations* of this Meaſure?

Philo. *Yards*, *Quarters*, and *Nails*: Alſo, *Ells Engliſh*, *Ells Flemiſh*, and *French Ells*, as appears by the Table.

TABLE.

2 Inches and a Quarter	make	1 Nail
4 Nails		1 Quarter of a Yard
4 Quarters		1 Yard
3 Quarters of a Yard		1 Ell *Flemiſh Meaſure*
5 Quarters, or 1 Yd. 1 qr.		1 Ell *Engliſh*
6 Quarters		1 *French* Ell

Note 1. That Things in common, ſuch as *Woollen*, *Linnen*, *Silk*, *Tape*, *Cord*, &c. are meaſured by the Yard: But *Hollands* are in general meaſured by the Ell *Engliſh*, and *Tapeſtry* by the Ell *Flemiſh*.

Note 2. That 16 Nails make a Yard, 20 Nails an Ell *Engliſh*, and 12 Nails an Ell *Flemiſh*.

(10) *Yds.*	(4) *qrs.*	(4) *Nails*	(10) *Ells Eng.*	(5) *qrs.*	(4) *N.*	(10) *Ells Fl.*	(3) *qrs.*	(4) *N.*
47	3	2	64	4	3	17	2	3
19	2	1	17	2	1	41	1	2
16	3	2	19	3	2	19	2	1
14	1	1	15	4	3	64	1	2
17	1	2	16	2	1	14	2	1
21	2	1	17	2	3	25	1	2
137	2	1						

LONG-MEASURE.

Tyro. What does *Long-Meaſure* teach?

Philo. To know the Length or Breadth of any Thing, and the Diſtance of one Thing, or Place from another, as by the following Table.

TABLE.

3 Barley Corns	make	1 Inch
12 Inches		1 Foot
3 Feet		1 Yard
2 Yards, or 6 Feet		1 Fathom
5 ½ Yards		1 Rod, Pole, or Perch
40 Rods		1 Furlong
8 Furlongs		1 Mile
3 Miles		1 League
20 Leagues, or 60 Miles		1 Degree
360 Degrees		The Circumference of the Earth and Sea

Note 1. An Hand, or Hands Breadth in Horſemanſhip is 4 Inches.
A common Pace is 2 Feet 6 Inches.
A geometrical Pace is 5 Feet.

(10) *Deg.*	(20) *Leag.*	(3) *Miles*	(8) *Fur.*	(40) *Rods*
25	19	2	7	21.
17	14	1	5	19
16	8	2	2	15.
21	5	1	4	27
47	7	2	1	14.
15	10	1	5	37
144	7	0	3	13

(10) *Rods*	($5\frac{1}{2}$) *Yds.*	(3) *Feet*	(12) *Inches*
42	4	1	11
61	3	0	10
17	1	1	9
24	0	2	8
16	2	1	7
72	1	0	6

Note 2. According to the Table 60 Miles make one Degree, therefore, the Earth is 21600 Miles round: But 69 $\frac{1}{2}$ Miles (very nearly) make but one Degree; and therefore the Circumference of the Earth is about 25000 Miles; as you will ſee in *Reduction.*

LAND-MEASURE.

Tyro. What are the Denominations of *Land-Meaſure?*

Philo. Almoſt the ſame as in *Long-Meaſure*; but as they never regard the Inches and Barley-Corns, this Table is ſufficient.

TABLE.

$5\frac{1}{2}$ Yards, or 16 Feet $\frac{1}{2}$	make	1 Rod, Pole or Perch
40 Rods, or Poles		1 Furlong in Length
40 Rods in Length, and 1 in Breadth		1 Rood, or Quarter of an Acre
4 Roods, or Quarters		1 Acre

Note 1. That though 16 $\frac{1}{2}$ Feet make a Statute, Pole, or Rod, yet it is cuſtomary in ſome low, Fenny Countries, and barren Lands, to allow 18 Feet, and in meaſuring Foreſt 21 Feet to the Pole.

(10) *Acres*	(4) *Roods*	(40) *Poles*	($5\frac{1}{2}$) *Yds.*
7	1	14.	1
9	3	27	2
4	1	29.	3
15	2	27	4
37	1	18	$4\frac{1}{2}$

(10) *Acres*	(4) *Roods*	(40) *Poles*
15	1	19
26	2	24
19	3	27
47	1	15

Note 2. The common Inſtrument uſed in meaſuring Land is an Iron Chain, containing 100 Links, which is 4 Rods, or 22 Yards in Length; therefore, 10 Chains in Length, and 1 in Breadth, make an Acre, and 8 Chains in Length only make a Mile, or 1760 Yards.

SQUARE-MEASURE.

Tyro. What do you mean by *Square-Meaſure?*

Philo. You are not to expect, *Tyro*, as yet, to know the Nature of it; it is ſufficient at preſent, that you only know this, that *Long-Meaſure* ſhews you only the Length or Breadth of any Thing; but *Square-Meaſure* tells you the Content of any Thing, which you can have no Notion of till you have learnt *Diviſion* *; but it will not be amiſs to learn the following Table by Heart (at your Leiſure) that you may be the better able to underſtand it by and by.

16 Square Quarters	make	1 Square Inch
144 Square Inches		1 Square Foot
9 Square Feet		1 Square Yard
30 Square Yds. 1 Qr. or 272 Square Feet 1 Quarter		1 Square Rod, or Pole
160 Square Rods		1 Acre of Ground

Note, One Example with Yards and Feet only will be ſufficient at preſent.

(10) *Yards*	(9) *Feet*
45	6
29	3
47	8
25	5

Of TIME.

Tyro. What is *Time*, and how is it divided?

Philo. *Time* ſhews us the Beginning, Mutation, (or Changing) Continuation, and Ending of all mutable Things. It is meaſured by *Years*, *Months*, *Days*, *Hours*, *Minutes*, and *Seconds*, and divided as follows, which will ſerve all common Purpoſes.

TABLE.

$60''$ Seconds	make	1 Minute of Time
$60'$ Minutes		1 Hour
24 Hours		1 Natural, or real Day
7 Days		1 Week
4 Weeks		1 Month
13 Months or 365 Days		1 Year

Note 1. Though the Table ſays 13 Months, or 365 Days make a Year, yet it is not truly ſo; for 13 Months (allowing 4 Weeks to the Month) is but 364 Days: Whereas 13 Months, 1 Day, 6 Hours make a Year; for theſe odd 6 Hours make 24 Hours, or 1 Day, every fourth Year, which is added to *February*, which has then 29 Days, and is called *Leap-Year*: But a true Year is 365 Days, 5 Hours, 48 Minutes, and is called a *Solar Year*, being the Time that the Sun performs its apparent Revolution through the *Ecliptic*; but you muſt not buſy yourſelf, and loſe your Time about theſe Things, which are too hard for you to underſtand at preſent.

Note 2. Though 13 Months are ſaid to make a Year, and Servants commonly reckon a Month 28 Days; yet you are to obſerve, that in Trade, and tranſacting Buſineſs, by a Month is meant a *Calendar Month*; that is, from any Day of the Month to the ſame Day of the next Month: Thus, from the 5th of *February* to the 5th of *March*, or from the 18th of *April* to the 18th of *May*, is a Month.

EXAMPLE 1.

(10) *Years*	(13) *Months*	(4) *Weeks*	(7) *Days*
27	11	3	6
43	9	2	5
27	5	1	4
36	1	2	3
45	10	2	1
28	12	1	4
209	12	2	2

EXAMPLE 2.

(10) *Days*	(24) *Hours*	(60) *Min.*	(60) *Sec.*
41	22	50	27
17	17	17	15
24	15	27	14
19	21	19	24
27	11	18	19
35	14	25	25

Note 3. In *Example* 2, you muſt point or dot at every Row but the laſt.

And now, *Tyro*, I think you may by this Time be perfect in *Addition*, I ſhall only ſet you a few Queſtions, and proceed to *Subtraction*.

SECTION VI.

Containing ſome other uſeful Things, neceſſary to be known in Number, Weight, *and* Meaſure.

Note 1. *Of Things bought and ſold by the* Dozen, Score, *or* Groſs.

A *Dozen* is 12. A *Score* is 20. A *common Hundred* is 100. A *long Hundred* is 120. A *Groſs* is 12 Dozen, or 144, and a *Great Groſs* is 12 Times as many, or 1728. *Oranges*, and *Lemons*, *Corks*, *Bungs*, and many other Things, are bought and ſold by the *Dozen*, or *Groſs*. *Herrings*, and ſeveral other Sort of Fiſh; and all Sorts of *Nails*, and many ſuch ſmall Things, have ſix Score, or 120, to the Hundred; but a Hundred of *Ling Cod* is 124 in Number; and a Hundred Books in Printing is 104.

Note 2. *Of* PARCHMENT *and* PAPER.

1 Dozen is 12 Skins; 5 Dozen 1 Roll of *Parchment*; 24, and ſometimes 25 Sheets make a Quire of *Paper*, 20 Quires 1 Ream, and 10 Ream 1 Bale.

Note 3. *Of the different Sizes of* BOOKS.

Folio is the largeſt of all Books, and has but 2 Leaves to the Sheet, *Quarto* (marked 4*to*.) has 4 Leaves to a Sheet. *Octavo*, (or 8*vo*.) is a Sheet doubled into 8 Parts; and *Duodecimo* (commonly called *Twelves*, and marked 12*mo*.) has 12 Leaves to the Sheet.

Note 4. *Of* WEIGHT, MEASURE, &*c*.

A *Faggot* of Steel 6 Score, or 120 *lb*. A *Burthen* or *Gad* of Steel 9 Score. A *Barrel* of Anchovies 30 *lb*. A *Barrel* of Figs from 98 to 300 *lb*. A *Barrel* of Gun-powder 1 *Cwt*. A *Puncheon* of Prunes from 10 to 12 *Cwt*. A *Ton*, or *Fother* of Lead 19 *Cwt*. 2 *qrs*. A *Quintal* of Fiſh 100 in Tale A *Stone* of Iron, Shot, or Horſeman's Weight 14 *lb*. A *Stone* of Meal 8 *lb*. A *Stone* of Hemp 32 *lb*. A *Stone* of Glaſs 5 *lb*. A *Seam* of Glaſs 24 *Stone*, or 120 *lb*. A *Keg* of Herrings, &*c*. 60 in Number, an *Hundred* is 120. A *Cade* of Sprats 1000. A *Cade* of Herrings 500. A *Barrel* 1200. A *Laſt* 12 Barrels, or 12,000. A *Laſt* of Corn, or Rape-Seed 10 *qrs*. A *Laſt* of Gun-powder 24 Barrels. A *Laſt* of Leather 20 Dickers. A *Dicker* 10 Skins. A *Laſt* of Hides 12 Dozen; of Tar 14 Barrels; of Wool 12 Sacks; of Flax, or Feathers 1700 *lb*.. A *Wey* in ſome Places is 5 Chaldron. A *Wey* of Meal 6 *qrs*. A *Gallon* of Train Oil $7\frac{1}{2}$ *lb*. A *Tun* 252 Gallons. A *Tun* of Sweet Oil 236 Gallons. A *Load* of Hay in ſome Places is 25, in others 30 *Cwt*. In *London* it is ſold in *Truſſes*, containing 56, or 60 *lb*. a Truſs, and 36 Truſſes to the Load. A *Load* of *Scotch* Coals 1 *Cwt*. A *Load* of Tiles 1000.

Of Bricks 500. Bricks in general are 9 Inches long, $4\frac{1}{2}$ Inches broad and $2\frac{1}{2}$ thick. A *Square* of Tiling or Thatching contains 10 Feet every Way, that is, 100 Feet, and a Rod of Brick-Work 272 Feet, 1 Quarter; but 272 is reckoned for common Work. A *Stack* of Wood is 3 Feet high, 3 Feet wide, and 12 Feet long; but this is according to the Agreement of the Maſter and the Workmen.

Tyro. I am extremely obliged to you, Sir; but pray am I bound to get theſe Things by Heart before I learn *Subtraction?*

Philo. Not at all, *Tyro:* Learn the Rules and the common Tables is ſufficient. The others I have only added for your further Inſtruction: They are not ſet you for a Taſk, but for Diverſion; and if you now and then read them over, you will ſoon find the Benefit of thus improving your Mind; ſince it will naturally gain you the Good-will of your Parents, your Maſter, and Mankind in general, rather than ſquandering away your Time in Idleneſs and Miſchief, beſides the Diſgrace of living and dying a Dunce.

SECTION VII.

Contains ſome uſeful and diverting Queſtions to exerciſe the Learner in Addition *only.*

Queſt. 1. A Man borrowed of his Friend a certain Sum of Money, and paid him in Part 15 *l.* 10 *s.* and left unpaid 24 *l.* 10 *s.* What did he borrow? *Anſ.* 40*l.*

Rule. *Add the two Sums together gives you the Anſwer.*

2. Suppoſe a Perſon was born in 1709, when will he be four Score Years old. *Anſ.* In 1789.

Rule. *Add as many to* 1709 *as will make it* 1789 *is the Anſwer.*

3. *A*, *B*, and *C* agreed to purchaſe an Eſtate, *A* laid out, or paid for his Part, 140*l* 10*s*. *B* paid 217*l*. 10*s*. *C* paid 500*l*. 10*s*. What did the Eſtate coſt? *Anſ*. 858*l*. 10*s*. Rule. *Add all the Sums together*.

4. A Factor bought 4 Bags of Hops, the firſt, (No. 1.) weighed 2 *C*. 1 *qr*, 14 *lb*. No. 2. 3 *qrs*. 17 *lb*. No. 3, 2 *C*. 3 *qrs*. 13 *lb*. and No. 4, weighed 1 *qr*. 27 *lb*. What is the Weight of all? *Anſ*. 6 *C*. 2 *qrs*. 15 *lb*. *Add all together is the Anſ*.

5. A Shop-keeper having opened a Shop, ſold the firſt Day as many Goods as came to 15*l*. 13*s*. 7*d*. $\frac{3}{4}$, and thus he went on for one Week, (*viz*. 6 Days) How much did he take in all? *Anſ*. 94*l*. 1*s*. 10*d*. $\frac{1}{2}$.

Rule. *Set down* 15. 13. 7 $\frac{3}{4}$, *ſix Times, and add them together gives the Anſwer*.

6. A Farmer carried out 100*l*. in Order to buy Cattle, and brought Home but 34*l*. 15*s*. 6*d*. What did he lay out? *Anſ*. 65*l*. 4*s*. 6*d*. For theſe two added together make juſt 100*l* and ſo on for any other Sum.

DIALOGUE. III.

SECTION I.

SUBTRACTION *in Whole Numbers*.

Tyro. WHAT does *Subtraction* teach?

Philo. *Subtraction* teaches to take a *leſs Number* from a *Greater* to diſcover the *Difference*. To prove the Work, add the *Difference* to the *leſs Number*, and if that Sum be the ſame as the *Greater*, the Work is right, otherwiſe falſe.

Tyro. How is *Subtraction* performed?

Philo. Quite contrary to *Addition*; for in *Addition* you uſe the Word *and*, but *here* you uſe the Word *from*. Thus 4 *from* 7, that is, 4 *taken out of* 7, there remains 3, for the *Difference.* Again, 5 *from* 10, there remains 5; and 6 *from* 14 there remains 8, and ſo for any other Numbers, as you may ſee by the following Examples.

	EXAMPLE 1.	Ex. 2.	Ex. 3.	Ex. 4.
	£.	*Yards*	*Ells*	*lbs.*
Greater Number	27	95	468	441756
Leſſer Number	14	61	162	240256
Difference	13	34	306	201500
Proof	27	95		

The WORK *in Words at Length.*

In *Example* 1. I ſay, 4 *from* 7 there remains 3; and 1 *from* 2 there remains 1. *To prove it*, I add the *Difference* to *leſs Numbers*, ſaying, 3 *and* 4 is 7, *and* 1 *and* 1 makes 2. In *Ex.* 2. I ſay 1 *from* 5 there remains 4; and 6 *from* 9 there remains 3. *Proof*, I ſay 4 *and* 1 is 5; 3 *and* 6 is 9: That is, 34 *and* 61 added together make 95, and ſo for the other Examples.

Tyro. This is quite plain indeed.

Philo. I ſhall work *Example* 3 and 4 in the ſame Manner, and leave you to prove them as I have directed. Obſerve then, *Ex.* 3, I ſay, 2 *from* 8 there remains 6; then 6 *from* 6, or 6 taken out of 6, there remains 0, and 1 *from* 4 there remains 3. *Laſtly*, in *Ex.* 4, I ſay, 6 *from* 6, there remains 0; then 5 *from* 5 there remains 0; 2 *from* 7 there remains 5; then 0 from 1, that is Nothing taken out of 1, there ſtill remains 1; then 4 *from* 4 there remains 0, and 2 *from* 4, 2.

Note, I ſhall give you an Example or two with, and without Cyphers, that you may endeavour to avoid that idle Cuſtom.

	Ex. 5. *with Cyph.*	*Without*	Ex. 6. *with Cyph.*	*Without*
From	24526	24526	84257	84257
Take	00012	12	84215	84215
Anſ.	24514	24514	00042	42

Tyro. I own that the Examples without the Cyphers look beſt, and I underſtand very well what you have ſhewn me.

Philo. I ſhall leave you then 3 or 4 Examples for Practice.

	Yards	*Ells*	*Hundreds*
From	47162	94785	347621
Take	12412	3104	301

Tyro. Now Sir, be pleaſed to ſhew me how to ſubtract or manage a Sum, when the lower Figure is ſometimes larger than the Top-one; for I think that it appears difficult to me at preſent.

Philo. Never fear; you will ſoon find it eaſy, if you do but obſerve the following Rule.

2. *When the lower Figure is larger than the Top-one, the* Rule *is,*

Take the lower Figure out of what you do by, which (in *whole Numbers* you know) is *Ten*, and to that Difference, or Remainder, add alſo the Top Figure, and *that* is the true Difference, which place under the firſt Row. This is what is called *Borrowing* in *Subtraction*, therefore, remember that you are always to carry 1 to the next lower Figure for ſo doing: An Example or two will make it quite plain.

	Ex. 1.	Ex. 2.	Ex. 3.	Ex. 4.
	£.	*Ells*	*Yards*	*Buſhels*
From	762	85420	760410	5217624
Take	145	17273	457146	3471276
Difference	617	68147		

Here in *Ex.* 1, I ſay 5 out of 2 I cannot have; therefore I take 5 out of 10, (which is what I do by here) and there remains 5, and the Top Figure 2 makes 7, which I place under the firſt Row, and carry 1 to the next lower Figure; ſaying, 1 that I carry to 4 makes 5, which taken out of 6, that is, 5 from 6 there remains 1; but now I carry Nothing to the next Figure, becauſe the lower Figure being leſs than the Top-one, I had no Occaſion to borrow; therefore, I only ſay in the laſt Row, 1 from 7, there remains 6: Again, in *Ex.* 2. I ſay, 3 from 0 I can't, but 3 from 10 there remains 7, and 0 is 7 ſtill; then I carry 1 to 7 is 8, from 2 I can't, but 8 from 10 there remains 2, and the Top Figure 2 makes 4: Then I carry 1 to 2, which is 3, ſaying, 3 from 4 there remains 1; but now I do not carry any to the next Figure, becauſe I did not borrow, but only ſay, 7 from 5 I can't take, but 7 from 10 there remains 3, and the Top 5 makes 8. *Laſtly*, I carry 1 to 1 is 2 from 8 there remains 6.

Tyro. This is plain enough.

Philo. This is the eaſieſt Way for a Learner, but there is another Method which is more practicable and expeditious, if you mind and learn it.

Another Way to ſubtract, *when the lower Figure is larger than the Top-one.*

When you cannot take the lower Figure from the Top-one, then count the Top Figure 10 more than it really is. Thus, if the Top Figure be 2 call it 12; if 3 call it 13; if 5 call it 15; if 8 call it 18, *&c.* and then take the lower Figure from it, and you have the true *Anſwer* or *Difference:* But always remember to carry 1 to the next Figure for ſo doing. This is called borrowing *Ten*, and your carrying 1 to the next Figure is paying of it again.

EXAMPLES.

	£.	*Yards*	*Ells*
From	75043	41725	172560
Take	27365	17258	87275
Difference	47678	24467	
Proof	75043	41725	

Firſt, I ſay 5 from 3 I can't; but calling 3, 13, I ſay 5 from 13, there remains 8; then I carry 1 to 6 is 7 from 4 I can't, but I ſay 7 from 14 there remains 7; then I carry 1 to 3 is 4 from 0 I can't, but 4 from 10 there remains 6. Again I carry 1 to 7 is 8 from 5 I can't, but 8 from 15 there remains 7. *Laſtly*, I carry 1 to 2 is 3 from 7 there remains 4.

☞ *Note*, Tho' the Bottom Figures in *Subtraction* may be larger than the Top-ones; yet you are to remember the laſt lower Figure is never larger than the Top-one when there is an equal Number of Figures.

Tyro. I underſtand you very well, Sir.

Philo. Then I ſhall only leave you an Example or two to try at as you have Leiſure.

More EXAMPLES.

	£.	℔.	*Miles*
From	417215	621700071	417621700
Take	241729	7210943	631720
Difference			

SEC-

SECTION II.

Of MONEY.

Tyro. HOW is *Subtraction of Money* performed?

Philo. By taking or ſubtracting every Denomination in the lower Line, out of, or from the upper Sum, as will appear more plain by the 2 following Rules.

Rule 1. When the lower Figures in the *Farthings, Pence,* or *Shillings,* are ſmaller than the Top-ones; then only ſubtract or take one from the other, and the Remainder is the true *Anſwer,* or *Difference,* which is placed under each Row to which it belongs.

Rule 2. When the lower Figures in the *Farthings, Pence,* or *Shillings,* are larger than the Top-ones; then ſubtract or take the lower Figure out of what you do by; that is, take the lower *Farthings* out of 4, the lower *Pence* out of 12, and the lower *Shillings* out of 20, taking in the Top Figure beſides; ſo ſhall this be the true *Difference,* or *Anſwer*; but remember, that you are always to carry 1 to the next Figure for borrowing, as you did in *Whole Numbers.*

Tyro. Pleaſe to give me an Example or two, I ſhall ſoon underſtand it.

Philo. You cannot miſs if you mind the Rule well.

	EXAMPLE 1.			EXAMPLE 2.			EXAMPLE 3.		
	£.	s.	d.	£.	s.	d.	£.	s.	d.
From	9	8	11	48	15	5	643	14	[illegible]
Take	7	5	6	27	11	3	231	11	2¼
Remains	2	3	5	21	4	2	412	3	4½
Proof	9	8	11	48	15	5	643	14	6¾
								1.	1

1. I begin at the Pence in *Example* 1, ſaying, 6 from 11 Pence, there remains 5 Pence, which I place under the Pence: Then I ſay 5 Shillings from 8, there remains 3 Shillings; and 7 Pounds from 9, there remains 2. So is the *Difference* 2*l.* 3*s.* 5*d.*

PROOF.

The Work is proved like *whole Numbers*, by adding the *Difference* to the *lower*, or *leſs Number*: Thus 5 Pence and 6 is 11 Pence; then 3 Shillings and 5 make 8 Shillings; and 2 added to 7 make 9 Pounds.

2. In *Example* 2, I ſay 3 from 5 there remains 2 Pence; then 11 from 15 there remains 4; then 7 from 8 there remains 1; and 2 from 4 there remains 2. *Ex.* 3, having Farthings, I ſay 1 Farthing from 3 there remains 2 Farthings, which I ſet down thus ½; then 2 from 6 there remains 4 Pence; then 11 from 14 Shillings there remains 3. *Laſtly*, for the Pounds I ſay, 1 from 3 there remains 2; then 3 from 4 there remains 1; and 2 from 6 there remains 4: So is the *Difference* or *Anſwer* 412*l.* 3*s.* 4*d.* ½. Now if you *add* this 412*l.* 3*s.* 4*d.* ½ to the lower Sum 231*l.* 11*s.* 2*d.* ¼, you will find they amount to the ſame as the Top Sum, *viz.* 643*l.* 14*s.* 6*d.* ¾.

Note, After this Manner is every Sum done and proved in *Subtraction.*

More Examples for Practice.

	£.	s.	d.	£.	s.	d.	£.	s.	d.
From	471	11	2¾	576	19	11½	409	11	5¾
Take	120	10	2	132	13	4¾	304	11	3½
Remains									

2. *When*

2. *When the* Shillings, Pence, *and* Farthings *are larger in the lower Line than in the Top-one.*

	EXAMPLE 4.			EXAMPLE 5.			EXAMPLE 6.		
	(10)	(20)	(12)	(10)	(20)	(12)	(10)	(20)	(12)(4)
	£.	s.	d.	£.	s.	d.	£.	s.	d.
Lent	10 –	4 –	6	42 –	11 –	6	453 –	13 –	$5\frac{1}{4}$
Received	7 –	10 –	8	17 –	14 –	10	326 –	15 –	$8\frac{3}{4}$
Due	2 –	13 –	10	24 –	16 –	8	126 –	17 –	$8\frac{1}{2}$
Proof	10 –	4 –	6	42 –	11 –	6	453 –	13 –	$5\frac{1}{4}$

Here I ſay 8 Pence from 6 Pence I can't; but 8 from 12 (which is what I do by at Pence) there remains 4, and the Top 6 makes 10: Then I carry 1 becauſe I borrowed, ſaying, 1 that I carry to 10 is 11 Shillings, which from 4 I can't take; but 11 from 20 (which is what I do by) there remains 9, and the Top 4 makes 13. *Laſtly*, I carry 1 to 7 is 8 from 10 there remains 2.

PROOF.

I prove theſe Examples the ſame Way as before, by adding the *Difference* to the *leſs Sum*, ſaying, 10 Pence, and 8 is 18 Pence, that is, 6 Pence above a Shilling, or 12 Pence; and I carry 1 to 13 is 14, and 10 is 24, which is 4 above 20 Shillings, or 1 *l.* *Laſtly*, I carry 1 to 7 is 8, and 2 makes 10.

Now *Tyro*, pray try you at *Example* 6, where there are Farthings.

Tyro. In *Example* 6, I ſay firſt, 3 Farthings from 1 Farthing I can't; but 3 Farthings from a Penny, or 4 Farthings, there remains 1, and the Top Farthing makes 2 Farthings, which I ſet down thus $\frac{1}{2}$: Then I carry 1 to 8 Pence is 9 Pence, which from 5 Pence I can't have; but 9 from 12 there remains 3, and the Top 5 makes 8 Pence: Again, I carry 1 to 15 is 16, from 13 I can't; but 16 from 20 there remains 4, and the Top 13 is 17 Shillings. *Laſtly*, I carry 1 to 6 is 7 from 3 I can't; but 7 from 13 there remains 6. Or 7 from 10 there remains 3, and the Top 3 is 6: Then I carry 1 to 2 is 3 from 5 there remains 2; but now carry none becauſe I did not borrow; therefore I only ſay 3 from 4 there remains 1.

PROOF.

I prove this, as before directed, ſaying, 2 Farthings and 3 is 5 Farthings, which is 1 Farthing above a Penny, and I carry a Penny to 8 is 9, and 8 is 17 Pence, 5 above 12, and I carry 1 to 17 is 18, and 15 is 33, which is 13 above 20, and I carry 1 to 6 is 7, and 6 is 13, which is 3 above 10, and I carry 1 to 2 is 3, and 2 is 5; then I ſay 1 and 3 is 4.

Philo. You have done very well indeed: I ſhall only ſet you an Example or two for Practice.

EXAMPLES *for Practice.*

	£.	s.	d.		£.	s.	d.
Borrowed	217 –	10 –		*Debtor*	1000 –		–
Paid	109 –	15 –	8¼	*Creditor*	910 –	15 –	6½
To pay				*Balance*			

Tyro. Theſe I can do very well; therefore wiſh you would ſhew me how to balance an Accompt, or make out a ſmall Reckoning.

Philo. That I will.

3. *Practical Queſtions for Buſineſs.*

	£.	s.	d.	£.	s.	d.
Queſt. 1. *A* borrowed of *B* ——				100		
A paid him at one Time	21	14	6			
At another 10 Guineas, *viz.*	10	10				
At another 20 Guineas, *viz.*	21					
At another Time	5	15				
Sold him Goods amounting to	18	14	9			
	77	14	3			
In all				77	14	3
What is ſtill due to *B*? *Anſwer*				22	5	9

Rule. I add up together all the Sums that *A* paid at different Times, and find they amount to 77*l.* 14*s.* 3*d.* which I place under 100*l.* and ſubtracting it therefrom, I find that there is ſtill due to *B* 22*l.* 5*s.* 9*d.* *Anſwer.*

Queſt. 2. *A* Blackſmith *delivered a Bill to a* Farmer *of* 45*l.* 14*s.* 6*d.* ¼, *and the Farmer has paid him in Part as under.*

	£.	s.	d.
By Caſh —— ——	20		
By 10 Buſhels of Malt ——	1	15	
By a Load of Hay —— ——	1	16	
By Meat at ſeveral Times ——	2	7	6
By 14 Buſhels of Oats ——	2	11	
By 20 Buſhels of Wheat ——	4	7	3
	32	16	9

	£.	s.	d.	
Blackſmith's Bill —— ——	45	14	6¼	
Farmer's Bill —— ——	32	16	9	
Balance due to the *Blackſmith*	12	17	9¼	*Anſwer*

Queſt. 3. A *Steward* collected as much Money for Rents as amounted to —— £. 4000
And remitted to his Maſter, as under.

By Caſh at one Time	500		
At another	500		
At another	210		
At another	420		
By Tax-Bills diſcounted	41	15	6½
By repairs done to the Eſtate	641	14	9
By other Charges	15	13	6¼
Laid out in all £.	2329	3	9¾
Which taken from the Top £. 4000			
there remains due to his Maſter £.	1670	16	2¼

Tyro. I underſtand you well.

Philo. Then I will leave you one *Queſtion* for Practice, and you may do the Work at Leiſure

Queſt. 4. Two Perſons *A* and *B* have a Reckoning to ſettle as follows. *A* lent *B* £. 300, and ſome Time after lent him 100 Guineas more: *B* paid him at 3 ſeveral Times, each 100 Guineas, and at another Time gave him a *Draught*, or *Note* upon C, for £. 50, and ſold him as many Goods as came to £. 34 - 4 - 6: Now I demand how the Balance ſtands between them. *Anſ.* There is ſtill due to *A* £. 5 - 15 - 6. To prove it,

Rule. Add the two Sums that *A* lent to *B* together, and you will find them £. 405; then ſet all that *B* paid in Caſh, and the *Draught*, and Goods all under one another, and add them together, which makes £. 399 - 4 - 6: This being done, ſet £. 399 4 - 6 under £ 405, and *ſubtract* it therefrom, and you will find there remains £. [illegible] 15 - 6 due to *A* on Balance.

Tyro. I will try it directly, and am ſure it is eaſy enough, but your Anſwer will be ſome Help to me I own.

Philo. As every Accompt of *Debtor* and *Creditor* is ſettled after this Manner, I ſhall give no more Examples, hoping by this Time you are capable of ſetting yourſelf Queſtions; and if you are not, it is highly neceſſary to look over the Examples once more, then will you be duly qualified for thoſe Queſtions I ſhall ſet you at the End of *Subtraction:* And therefore we will proceed to *Weights* and *Meaſures*, where you will find ſome Examples done for your Inſtruction, and ſome left undone for your Practice.

AVOIRDUPOIS-WEIGHT.

	Ton	C.	qr.	lb.		C.	qrs.	lb.	oz.	dr.
Bought	17	11	1	15	*Bought*	47	1	17	11	14
Sold	14	17	3	21	*Sold*	19	0	25	10	15
Unſold	2	13	1	22	*Unſold*					

Now *Tyro* I ſhall ſhew you this firſt *Example*, but no more; becauſe all other Sums in every one of the Rules are done in the ſame Manner, and there is no Occaſion for further Inſtruction.

Firſt, I ſay 21 from 15 I can't; but 21 from 28 (which is what I do by at *lbs.*) there remains 7, and 15 makes 22: Then I carry 1 to 3 is 4 from 1 I can't; but 4 from 4 (which is what I do by at *qrs.*) there remains 0, but the Top 1 is 1, which I ſet down. Again, I carry 1 to 17 is 18 from 11 I can't; but 18 from 20 there remains 2 and the Top 11 makes 13. *Laſtly*, I carry 1 to 4 is 5 from 7, there remains 2, and the Work is done.

Tyro. I thank you Sir; Examples now without Words will be ſufficient.

Note, If you forget what you do by, turn to your Tables in *Addition*.

TROY-WEIGHT.

	lb.	*oz.*	*dw.*	*gr.*		*lb.*	*oz.*	*dw.*	*gr.*
Bought	14	5	15	14	*Bought*	214	10	17	11
Sold	9	9	13	17	*Sold*	109	10	17	15
Remains	4	8	1	21	*Remains*				

DRY-MEASURE.

	Loads	*Buſh.*	*Pecks*	*Pints*		*Chal.*	*Buſh.*	*Pecks*
Bought	42	17	2	12	*Bought*	291	21	2
Sold	17	34	2	14	*Sold*	173	27	3
Unſold	24	22	3	14	*Unſold*			

WINE-MEASURE.

	Buts	*Hbds.*	*Gall.*	*Pints*		*Hbds.*	*Gall.*	*Pints*
Bought	14	1	47	0	*Bought*	64	35	1
Sold	9	0	51	5	*Sold*	17	46	2
Unſold	5	0	58	3	*Unſold*			

WINCHESTER-MEASURE.

	Bar.	*Gall.*	*Pints*		*Butts*	*Hbds.*	*B.*	*Gall.*
Brewed	124	21	4	*Brewed*	21	1	1	20
Sold out	92	27	6	*Sold out*	15	1	0	26
Unſold	31	29	6	*Unſold*				

Note, I have reckoned 36 Gallons to the Barrel, that being cuſtomary in ſelling Beer in moſt Places, as I ſaid before.

CLOTH-MEASURE.

	Yds.	*qrs.*	*Nails*	*Ells Eng.*	*qrs.*	*N.*	*Ells Fl.*	*qrs.*	*N.*
Bought	147	1	0	47	1	3	47	2	0
Sold	96	3	2	18	2	3	29	2	1
Rem.	51	1	2						

LONG-MEASURE.

	Deg.	*Leag.*	*Miles*	*Fur.*	*Rods*	*Yds.*	*Feet*	*Inc.*	*B.Corns*
From	471	14	1	3	17	2	1	10	1
Take	167	17	1	5	21	3	1	10	2
Rem.	303	16	2	5	35	3½	2	11	2

LAND-MEASURE.

	Acres	*Roods*	*Poles*	*Yds.*	*Acres*	*Roods*	*Poles*
From	471	2	15	3	47	1	15
Take	196	2	26	4	19	2	29
Rem.	274	3	28	4½			

TIME.

	Years	*Mths.*	*Weeks*	*Days*	*Hours*	*Days*	*Hours*	*Min.*	*Sec.*
From	319	10	3	3	17	45	17	25	17
Take	193	11	3	5	21	19	21	43	35
Rem.	25	11	3	4	20				

Note, In the firſt Example I reckon 13 Months to a Year.

Tyro. Sir, I am obliged to you for the Pains you have taken; I underſtand you very well, and will try at all thoſe Sums you have left undone.

Philo. That is enough, we will finiſh *Subtraction* then with *Section* 3.

SECTION III.

Containing ſome uſeful QUESTIONS *to exerciſe the Learner in both* RULES.

Queſt. 1. KING *Harry* the Eighth died 1547; I demand how many Years it is, this being now 1753. *Anſwer* 206 Years.

Queſt. 2. Suppoſe this preſent Year 1753, you were 19 Years old, what Year was you born in. *Anſ.* 1734.

Queſt. 3. A Boy had 1000 Marbles, and he loſt at 3 different Times at Play, each 175, and at another Time 150, how many has he ſtill in Hand? *Anſ.* 325.

Rule. Set down 175 three Times, and 150 under that; and then add all of them together, and take the Sum out of 1000, and the Anſwer will be 325 left. This *Rule* ſerves for all that follows.

MONEY.

4. *A* lent *B* £. 500, and *B* paid him 4 Times, each £. 120, 10 *s.* What is due to *A?* *Anſ.* £. 18.

5. What Sum of Money muſt I add to £. 58 - 14 - 6¾ to make it up £. 100? *Anſ.* £. 41 - 5 - 5¼.

6. *A Proof to Queſtion* 5. What Sum muſt I take out of £. 100, to have the Remainder £. 58 - 14 - 6¾. *Anſwer* £. 41 - 5 - 5¼.

7. A Collector of the Exciſe received £. 2040 - 14 - 5¼, and remitted, or paid at 3 ſeveral Times, each £. 500, and at another Time 100 Guineas; What has he ſtill in Hand? *Anſ.* £. 435 - 14 - 5¼.

AVOIRDUPOIS-WEIGHT.

8. Bought 6 *Ton*, 14 *Cwt.* of Iron, and ſold at one Time, 3 *Ton*, 11 *C.* 2 *qrs.* and at ſeveral other Times, ſold by Retail 15 *C.* 3 *qrs.* 17 *lb.* What remains unſold? *Anſwer* 2 *Ton*, 7 *C.* 2 *qr.* 11 *lb.*

TROY-WEIGHT.

9. A Gentleman delivered to a Silverſmith 2 *lb.* 5 *oz.* 11 *dwts.* of Silver; and he received a Silver Cup, which weighed 11 *oz.* 14 *dwts.* and at another Time, 6 large Spoons, weighing 1 *lb.* 2 *oz.* 3 *dwts.* 14 *grs.* What Weight of Silver has the Silverſmith ſtill in Hand. *Anſ.* 3 *oz.* 13 *dwts.* 10 *grs.*

LIQUID-MEASURE.

10. A common Brewer has 2 Goils of new Beer, containing 32 Butts, 2 Barrels, 24 Gallons of Strong; and 15 Butts, 1 Barrel of Small. And he ſent to one Victualler 8 Butts, 2 Barrels, to another 11 Butts, and ſtarted into his own Store-houſes 5 Butts, 2 Barrels, 27 Gallons of the Strong; and of the Small 7 Butts, 2 Barrels; he alſo ſold out by Retail of the Small, 4 Butts, 23 Gallons: I demand what remains of the Brewing, both of the Goil of Strong, and the Goil of Small? *Anſ.* 7 Butts, 33 Gallons of Strong, and 3 Butts, 1 Barrel, 13 Gallons of Small.

☞ *Note*, I have added the Anſwers, that you may know when you are right or wrong: If you cannot do all theſe Queſtions as yet, it is of no great Signification; you muſt not ſtop your Progreſs in going forward, becauſe of that. Now follows

DIALOGUE IV.

MULTIPLICATION.

SECTION I.

Tyro. WHAT is *Multiplication?*

Philo. Multiplication is a compendious or ſhort Way of *Addition*, and teaches us to tell the Product of a Sum in one Line only, which would require ſeveral *Additions.*

Tyro. What elſe is required?

Philo. There are three Things to be carefully obſerved in *Multiplication.*

Firſt, The *Multiplicand*, which ſtands a-top, and is that Number given to be multiplied.

Secondly, The *Multiplier*, or Sum you multiply by.

Thirdly, The *Product*, or *Anſwer*, which is the *Multiplicand* multiplied by the *Multiplier.*

Tyro. Pleaſe to explain this a little more.

Philo. Let us take any two Numbers, ſuppoſe 8 and 3. I ſet down 8 and place 3 under it; ſo is 8 the *Multiplicand*, 3 is the *Multiplier*, and 24 is the *Product*, or *Anſwer*, becauſe 3 Times 8 make 24. Is this plain enough?

Tyro. Yes Sir, I underſtand you now.

Philo. Very well, *Tyro*, then I would have you get the following Table by Heart, by all Means, notwithſtanding it is too cuſtomarily omitted.

MULTIPLICATION TABLE.

Once 1 is 1

2 Times, or Twice	2	is	4
	3		6
	4		8
	5		10
	6		12
	7		14
	8		16
	9		18

3 Times	3	is	9
	4		12
	5		15
	6		18
	7		21
	8		24
	9		27

4 Times	4	is	16
	5		20
	6		24
	7		28
	8		32
	9		36

5 Times	5	is	25
	6		30
	7		35
	8		40
	9		45

6 Times	6	is	36
	7		42
	8		48
	9		54

7 Times	7	is	49
	8		56
	9		63

8 Times	8	is	64
	9		72

9 Times	9	is	81
10 Times	10		100
11 Times	11		121
12 Times	12		144

Table of Twelves.

12 Times	2	is	24
	3		36
	4		48
	5		60
	6		72
	7		84
	8		96
	9		108
	10		120
	11		132
	12		144

Note 1. You ſhould be very careful to get the *Table* by Heart, as I ſaid before: Saying thus, 2 Times 2, or twice 2 is 4, twice 3 is 6, twice 4 is 8, twice 5 is 10, &c.

Note 2. You ſhould alſo at Leiſure learn to *box* the *Table* well; that is, to ſay it backwards, forwards, or any Way. Thus you ſee twice 5 is 10, that is, 5 Times 2 is 10: Again, 3 Times 9 is 27; ſo alſo is 9 Times 3 the ſame. So 6 Times 12 is the ſame as 12 Times 6, and 5 Times 9 the ſame as 9 Times 5.

1. *To multiply by ſingle Figures.*

Rule. Multiply every Figure in the *Multiplicand* by the Figure in the *Multiplier*, carrying 1 for every 10, as in *Addition of whole Numbers*, and you have the *Product* or *Anſwer*.

EXAMPLE 1.		EXAMPLE 2.	
Multiplicand	17	*Multiplicand*	78
Multiplier	5	*Multiplier*	6
Product	85	*Product*	468

I begin with the *Multiplier* 5, ſaying, 5 Times 7 is 35, and ſet down the 5, and I carry 3; then I ſay 5 Times 1 is 5, and 3 that I carried is 8; ſo is the *Product*, or *Anſwer*, 85. Again,

In *Ex*. 2. I ſay, 6 Times 8 is 48; that is 8, and I carry 4; then 6 Times 7 is 42, and 4 I carried is 46: So is this *Product* 468.

2. *To prove the Work by* Addition.

I ſet the *Multiplicand* 17 down 5 Times; and the *Multiplicand* 78 I ſet down 6 Times, and adding them together, I find 85, and 468, as before; which you may try on your Slate at Leiſure.

Tyro. I ſee plainly that *Multiplication* ſaves the Trouble of many *Additions*.

Philo. There is another Way to prove *Addition*; but as it is of no Manner of Signification, we will lay aſide thoſe puzzling Curioſities, and proceed to

EXAMPLE 3.		EXAMPLE 4.		EXAMPLE 5.
Multiply	472	24970	and	590407
by	8	*by* 9	*by*	7
Anſwer	3776	*Anſ.* 224730	*Anſ.*	4132849

Tyro. I ſay 8 Times 2, (or twice 8) is 16, 6 and I carry 1; then 8 Times 7 is 56, and 1 is 57; that is, 7, and I carry 5; then 8 Times 4 is 32, and 5 I carried is 37. In *Ex.* 4, I ſay, 9 Times (0) Nothing is 0; then 9 Times 7 is 63, that is 3, and I carry 6; then 9 Times 9 is 81, and 6 I carried is 87, that is 7, and I carry 8; then 9 Times 4 is 36, and 8 is 44, that is, 4 and I carry 4; and *laſtly*, 9 Times 2 is 18, and 4 I carried is 22. Alſo, in *Ex.* 5, I ſay, 7 Times 7 is 49, that is 9, and I carry 4; 7 Times 0 is 0, but 4 is 4 ſtill; then 7 Times 4 is 28, that is 8, and I carry 2; then 7 Times 0 is 0, but 2 is 2; then I carry none, but ſay, 7 Times 9 is 63, that is 3, and I carry 6; and *laſtly*, 7 Times 5 is 35, and 6 is 41.

Philo. Very well done indeed! I leave theſe two Examples for Practice.

Multiply	49997296	and	94171470
by	9	*by*	8
Anſwer		*Anſwer*	

Tyro. Pleaſe to give me an Example or two to *multiply* by 12 in one Line; for I know it is done much quicker, and it is as eaſy as to make two of it.

EXAMPLES *with Twelves.*

Multiply	42576	and	994079	and	99807
by	12	*by*	12	*by*	12
Anſwer	510912	*Anſ.*	11928948	*Anſ.*	

Firſt, 12 Times 6 is 72, that is 2, and I carry 7; then 12 Times 7 is 84, and 7 I carried is 91, that is 1, and I carry 9; then 12 Times 5 is 60, and 9 I carried is 69, that is 9, and I carry 6; then 12 Times 2 is 24, and 6 is 30, that is 0, and I carry 3; and *laſtly*, 12 Times 4 is 48, and 3 is 51. And thus by having the *Table of Twelves* perfectly by Heart, every Sum will be eaſy to you.

Tyro. It is eaſy enough, I ſee: Pleaſe now to ſhew me how you multiply by 2, 3, 4, or more Figures.

Philo. This you will ſoon underſtand.

2. *Of multiplying by ſeveral Figures.*

Rule. When there are ſeveral Figures in the *Multiplier*, then you begin at the firſt Figure in the Units Place, and multiply it through, or into every Figure of the *Multiplicand*, as you have done before. This being done, multiply every Figure in the *Multiplicand* by the ſecond Figure of the *Multiplier*; only obſerve to ſet the firſt Figure of this ſecond Row under the *Ten's Place* of the firſt Row; and thus you go on with the third Figure in the *Multiplier*, placing the *Units Place* of each ſucceeding Row under the *Tens Place* of the Row that is above it, till you have gone through every Figure of the *Multiplier*. Then draw a Line under all the Rows of Figures, and add them together, and the Sum is the true *Product*, or *Anſwer*.

Note, Be ſure you remember that you ſet your Figures right under one another, or elſe in a large Sum you will be puzzled to add the Work together.

EXAMPLES *with ſeveral Figures.*

EXAMPLE I.		PROOF.	
Multiply	89	*Multiply*	47
by	47	*by*	89
	623		423
	356		376
Anſwer	4183	*The ſame*	4183

In *Example* 1, I ſay, 7 Times 9 is 63, that is 3, and I carry 6; then 7 Times 8 is 56, and 6 I carried is 62, which I ſet down; ſo is the firſt Line or Row finiſhed: Then I take the ſecond Figure of the *Multiplier*, ſaying, 4 Times 9 is 36, which 6 I ſet under the 2, or *Tens Place* of the firſt Line, and carry 3; and then I ſay, 4 Times 8 is 32, and 3 that I carried is 35, placing the 5 under the 6, and the 3 quite out towards the Left-hand. *Laſtly*, I add theſe up in Order, as they ſtand, ſaying, 3 is 3; then 6 and 2 is 8; again, 5 and 6 is 11, that is 1, and I carry 1 to 3 is 4.

To prove MULTIPLICATION.

It is a common Way to prove *Multiplication* by the Croſs; but it is ſubject to ſo many Errors, that in ſhort, it is no Proof at all to a Learner, but rather a Corruption. The beſt Way therefore is this: Take the *Multicand* and ſet it below, and the *Multiplier* a-top, that is, change the *Multiplicand* into the *Multiplier*, and proceed as before directed, and if the *Product* be the ſame as before, your Work is entirely right. See the next Examples wrought at large both Ways.

EXAMPLE 3.		PROOF.	
Multiplicand	895	*Multiplicand*	798
Multiplier	798	*Multiplier*	895
	7160		3990
	8055		7182
	6265		6384
Product	714210	*The ſame*	714210

Firſt, I ſay, 8 Times 5 is juſt 40; therefore I ſet down the 0, and I carry 4; then 8 Times 9 is 72, and 4 I carried is 76, that is 6, and I carry 7; then 8 Times 8 is 64, and 7 I carried is 71. Now I take the ſecond Figure, ſaying, 9 Times 5 is 45; which 5 I place under the ſecond Figure, or *Tens Place* of the firſt Line, and carry 4, ſaying, 9 Times 9 is 81, and 4 is 85, which 5 I place under the Figure 1, and carry 8 to the next Figure, ſaying, 9 Times 8 is 72, and 8 that I carried is 80. And now I come to the laſt Figure of the *Multiplier*, ſaying, 7 Times 5 is 35, which 5 I place under the ſecond Figure of the laſt Line, and carry 3 to the next Figure; ſaying, 7 Times 9 is 63, and 3 I carried is 66, that is, 6 and I carry 6; then 7 Times 8 is 56, and 6 is 62. *Laſtly*, I add theſe up in Order, as they ſtand, and find the *Product* 714210.

The Proof of this Example is worthy your Obſervation, *Tyro*; for be the Sum ever ſo large, if you change the *Multiplicand* into the *Multiplier*'s Place, and multiply right, you will find the *Product* always the ſame.

Tyro. I ſee it plainly, Sir; and I could not have thought *Multiplication* had been ſo eaſy.

Philo. Nothing eaſier, when the *Table* is once well learned. I ſhall now give you two more Examples, and leave the reſt undone for Practice.

EXAMPLE 4.

```
Multiply   913876
      by     8759
      -----------
          8224884
         4569380
        6397132
       7311008
      -----------
       8004639884
```

EXAMPLE 5.

```
and        749076
      by     1795
      -----------
          8745380
         6741684
        5243532
       749076
      -----------
       1344591420
```

EXAMPLES *for Practice.*

```
Multiply 4567879        Multiply 9567950
      by   45769              by   32796
      ----------              ----------
```

☞ *Note*, Remember *Tyro*, that when you multiply by ſeveral Figures, that you always ſet the firſt Figure of the ſecond Line under the ſecond Figure of the firſt Line, and the firſt Figure of the third Line under the ſecond Figure of the ſecond Line; and thus go on, leaving one Figure out towards the Right-hand every Line, ſetting the next Line one Figure more towards the Left hand, and every Figure under one another in their proper Place.

Tyro. I underſtand you well, Sir.

Philo. Then I will ſet you but one Example more, which you may prove yourſelf.

```
Multiply          987654321
     by           123456789
         ------------------
                 8888888889
                7901234568
               6913580247
              5925925926
             4938271605
            3950617284
           2962962963
          1975308642
          987654321
         ------------------
Anſwer   121932631112635269
```

PROOF.

```
Multiply 123456789
      by 987654321
         ---------
```

3. *Of Cyphers between the Figures*, &c.

The moſt difficult Thing in this Rule, is when the *Multiplier* has ſome Figures, ſome Cyphers; but if you be careful to mind the Work of an Example or two, you will ſoon underſtand it, as I ſhall explain them in Words.

EXAMPLE 1.

```
Multiply       49657
      by       30705
         -----------
              248285
            3475990
          1489710
         -----------
Anſwer    1524718185
```

EXAMPLE 2.

```
Multiply            7564965
      by         5003007000
         ------------------
                52954755000
              2269489500
          3782482500
         ------------------
Anſwer    37847572849755000
```

Note, Pray obſerve, that you read the following Inſtructions once or twice over, if you do not underſtand the Work.

Firſt, I begin at the 5, and multiply all the Top Figures by it, as before: Now as the next Figure of the *Multiplier* is a Cypher, it is of no Signification to multiply by *that*, becauſe it will produce Nothing but a Line of Cyphers: Therefore, I bring it down, that is, I ſet a Cypher under the Figure 8, and then begin to multiply by the 7, ſaying, 7 Times 7 is 49, 9 and I carry 4; which 9 I ſet down in the ſame Line, on the Left-hand of the Cypher, and go on ſtill to multiply by the 7; then as the next Figure is a Cypher again, I ſet down a Cypher under it, as I did before, leaving the 9, and the Cypher which ſtands by it, in the laſt Line, both ſtanding out towards the Right-hand. This being done, I only multiply by the 3, and ſet it in the ſame Line, and add all up, and the Work is done. Again,

In *Example* 2, there are 3 Cyphers at the Beginning of the *Multiplier*, therefore I ſet 3 Cyphers under the Line, right under them: Then multiply by the 7 as in all other Sums; ſaying, 7 Times 5 is 35, &c. Then I come to 2 Cyphers more in the *Multiplier*, and therefore, I ſet 2 Cyphers right under them, and then multiply by the 3, and place the Product by the Side of the 2 Cyphers: Then, as there are two Cyphers, I again ſet down two Cyphers, thus, 00, under them, and then multiply by the 5, placing the Product by the Side of them. *Laſtly*, I add the Sum up as it ſtands, and it is done.

Note, Theſe Examples are proved like the others, by ſetting the *Multiplier* a-top, and the *Multiplicand* under it.

More Examples for Practice.

Multiply	570965	and	71900072
by	2400500	*by*	5000960000

And now *Tyro*, I ſhall finiſh this *Section* with ſhewing you ſomething of *Contractions*, or *Compendiums*.

4. *Of* CONTRACTIONS.

When any Number of Figures are given to be multiplied by 10, 20, 30, 40, 80, 90, 120, 1200; then ſet the Cyphers out, and multiply by the Figure, or Figures, and place the *Product* by the Side of the Cyphers, as before, gives the *Anſwer*.

Multiply	275	and	3275	and	6759
by	20	*by*	90	*by*	1200
Anſwer	5500	*Anſ.*	294750	*Anſ.*	8110800

2. When you are to multiply by 1, the *Anſwer* will be the ſame as the *Multiplicand* itſelf is. If you are to multiply by 10, add 1 Cypher to the *Multiplicand*; if by 100, add 2 Cyphers; if by 1000, add 3 Cyphers: See the Work two Ways.

Multiply	1753		1753		1753
by	100		1000		10000
Anſwer	175300	*Anſwer*	1753000	*Anſ.*	17530000

Or rather thus:

Multiply 1753	*by* 1	*Anſwer* the ſame, *viz.*		1753
	by 10	add 1 Cypher,	*Anſ.*	17530
	by 100	add 2 Cyphers,	*Anſ.*	175300
	by 1000	add 3 Cyphers,	*Anſ.*	1753000
	by 10000	add 4 Cyphers,	*Anſ.*	17530000

And thus for as many Cyphers as you pleaſe.

Tyro. The Examples are quite plain and eaſy.

Philo. I am glad that you underſtand them; for now I ſhall ſhew you *that* which will ſerve you for all common Buſineſs, in caſting up any Sort of Goods; and pray be careful to mind it well; for there is not a more uſeful Thing in all common *Arithmetic*, it being a ſhort Way of working the *Rule of* 3, without *Diviſion*.

QUESTIONS *performed by* Multiplication.

Tyro. How are theſe Queſtions performed?

Philo. By the following Rule, *viz.*

Multiply the Price by the given Number, or Quantity, and carry 1 for every 4, 12, and 20, as you do in *Addition of Money*, and 1 for every 10 in the Pounds, as in *Whole Numbers*.

An Example or two well explained will ſoon make it eaſy to you.

	£.	s.	d.	
Queſt. 1. What coſt 3 Ells, at	0 –	5 –	3	an Ell?
			3	
	£. 0 –	15 –	9	*Anſ.*

Here I multiply the Price by the Quantity; ſaying, 3 Times 3 is 9 Pence, which I place under the Pence; and then ſay, 3 Times 5 Shillings is 15, which I place under the Shillings, and the Anſwer is 15 Shillings, and 9 Pence.

☞ You muſt remember, that 3 Ells, at 5 *s.* 3 *d.* an Ell, is the ſame as 3 Yards, or 3 Groſs, or 3 Gallons, or any other Name whatſoever; for it is only 3 Times 5 Shillings, and 3 Pence.

2. What comes 5 Groſs of any Thing to, at } £. 0 – 6 – 8 a Groſs?
5
£. 1 – 13 – 4 *Anſ.*

Here I multiply the Price by 5, ſaying, 5 Times 8 is 40 Pence, (which is 3 Shillings and 4 Pence) therefore I ſet down 4 under the Pence, and carry 3, and then 5 Times 6 Shillings is 30, and 3 I carried is 33 Shillings, which is 1 *l.* 13 *s.* that is 13, and I carry 1; and then I ſay, 5 Times 0 is 0, but 1 is 1.

3. How much does 7 Times 8 Shillings and 9 Pence amount to? Or,
What coſt 7 Reams of Paper at } £. 0 – 8 – 9 a Ream
7
£. 3 – 1 – 3 *Anſ.*

Here I ſay, 7 Times 9 is 63 Pence, which is 5 Shillings, and 3 Pence, that is 3, and I carry 5; then 7 Times 8 is 56 Shillings, and 5 I carried is 61; that is 3 *l.* 1 *s.* or, which is the ſame, it is 3 Twenties, and 1 over; therefore, I ſet 1 under the Shillings, and carry 3 to the Pounds, ſaying, 7 Times 0 is 0, but 3 is 3: So is the Anſwer 3 *l.* 1 *s.* 3 *d.*

Note, Tho' I have ſet Cyphers in the Place of Pounds in theſe Examples, and have alſo ſet £ *s. d.* over the Sums, yet it is better to leave out the Cyphers, and more practicable, to make only a great £ before the Pounds, as in the following Examples.

4. What coſt 9 Gallons of Brandy, or any Thing elſe, at —— —— —— £. - 8 - 3¼ a Gallon
9
————
£. 3 - 14 - 5¼ *Anſ.*

Here I multiply the Price by 9, beginning at the Farthings, ſaying, 9 Farthings is 2 Pence Farthing, that is 1 Farthing, and I carry 2 Pence; then 9 Times 3 is 27 Pence, and 2 Pence I carried is 29 Pence, which is 2 Shillings, and 5 Pence; therefore, I ſet down 5 under the Pence, and carry 2, ſaying, 9 Times 8 is 72 Shillings, and 2 I carried is 74. Now 74 Shillings is 3 *l.* 14 *s.* therefore, as there is Nothing in the Pounds to multiply, I ſet down 3 *l.* 14 *s.* *viz.* the 14 under the Shillings Place, and the 3 towards the Left-hand.

Tyro. This is very pretty, and very eaſy: Pleaſe to try me with an Example.

Philo. There is no Doubt but you will do it.

5. A Gentleman gave 10 poor Widows three Half Crowns a-piece: How much did he give in all? Or thus, What coſt 10 Buſhels of any Thing, at a Buſhel. } £. - 7 - 6
10
————
£. 3 - 15 - 0

Tyro. I ſet down 3 Half Crowns, that is, 7 *s.* 6 *d.* and multiply it by 10, ſaying, 10 Times 6 is 60 Pence, that is juſt 5 Shillings; therefore, I ſet down Nothing (0) and carry 5; then I ſay, 10 Times 7 is 70, and 5 I carried is 75 Shillings; which is 3 *l.* 15 *s.* So is the Anſwer £. 3 - 15.

6. What comes 12 Months }
Wages to, at } £. 1 - 8 - $6\frac{1}{4}$ a Month?
12

Anſ. £. 17 - 2 - 3

Or how much is 12 Times £. 1 – 8 – $6\frac{1}{4}$

Here I ſay, 12 Farthings is 3 Pence, that is 0, and I carry 3; then 12 Times 6 is 72, and 3 I carried is 75 Pence, which is 6*s* 3 Pence; I therefore ſet down 3, and carry 6; then I ſay, 12 Times 8 is 96 Shillings, and 6 I carried is 102 Shillings, which is 5 *l.* 2 *s.* ſet down 2, and carry 5; then I ſay 12 Times 1 is 12, and 5 I carried is 17 *l.* So is the Anſwer £. 17 – 2 – 3.

2. *Of double Figures in the Shillings.*

When you come to double Figures, ſuch as 14, 17, 18 or the like, multiply them like *Whole Numbers*, and then caſt out the Twenties, that is, count how many Times 20 you can have in the Number, and it is done. There are ſeveral other Ways I ſhall ſhew you, and always take *that* which appears eaſieſt to you, till perfect.

7. What coſt 5 Sheep, at £. 1 – 17 – 6 each? Or, what is 5 Times £. 1 – 17 – 6
5

Anſ. £. 9 – 7 – 6

Here I ſay 5 Times 6 is 30 Pence, is 2 *s.* 6 *d.* that is 6 and I carry 2; then I multiply the whole 17 by 5, ſaying 5 Times 7 is 35, and 2 I carried is 37, 7 and I go 3, then 5 Times 1 is 5, and 3 is 8, that is 87 Shillings, which is 4 *l.* 7 *s.* that is 7, and I carry 4; then 5 Times 1 is 5, and 4 is 9.

Or thus:

I multiply firſt the 7 by the 5, ſetting down the Product on a Slate, or a Piece of Paper, ſaying, 5 Times

7

7 is 35, and 2 I carried is 37 Shillings, or 1 *l.* 17 *s.* then I ſay 5 Times 10 is 50 Shillings, or 2 *l.* 10 *s.* and add this to 1 *l.* 17 *s.* it makes 4 *l.* 7 *s.* as before. See the next Example.

8. What coſt 7 Gallons, at £. 1 - 15 - 9¼ a Gallon?
7
£. 12 - 10 - 4¾ *Anſ.*

Here I ſay, 7 Farthings is 1 Penny, 3 Farthings, therefore, I ſet down ¾ and carry 1; then 7 Times 9 is 63, and 1 is 64 Pence, that is 5 *s.* and 4 *d.* 4 and I carry 5; then 7 Times 5 is 35, and 5 is 40, 0 and I carry 4; 7 Times 1 is 7, and 4 is 11, that is, 110 Shillings in all, which is 5 *l.* 10 *s.* that is 10, and I carry 5; and *laſtly*, 7 Times 1 is 7, and 5 is 12.

Or thus, 7 Times 5 is 35, and 5 is 40 Shillings, that is 2 *l.* which I ſet down any where on a Slate; then I ſay, 7 Times 10 Shillings is 3 *l.* 10 *s.* Now 3 *l.* 10 *s.* and 2 *l.* is 5 *l.* 10 *s.* as before. Again,

9. What coſt 12 Quarters of Malt, at a Quarter } £. 1 - 14 - 6
12
Anſ. £. 20 - 14 -

Here I ſay 12 6 Pences is 6 Shillings, that is 0, and I carry 6; then 12 Times 4 is 48, and 6 is 54, 4, and I carry 5; 12 Times 1 is 12, and 5 is 17; that is 174 Shillings, which is 8 *l.* 14 *s.* that is 14, and I carry 8; then 12 Times 1 is 12, and 8 is 20 Pounds. Or,

By the ſecond Way, 12 6 Pences is 6 Shillings, as before, 0, and I carry 6; then 12 Times 4 is 48, and 6 is 54, that is 2 *l.* 14 *s.* then 12 Times 10 Shillings is 6 *l.* Now 6 *l.* and 2 *l.* 14 *s.* is 8 *l.* 14 *s.* as before, that is 14, and I carry 8; then 12 Times 1 is 12, and 8 is 20.

Tyro. I underſtand both the Ways very well.

Philo. Take which you think is eaſieſt, they both anſwer the ſame End.

Tyro. But ſuppoſe I have a larger Quantity than 12, how muſt I multiply the Price by that Number?

Philo. By the following Rule.

3. *When there are 2 Figures to multiply by.*

Rule. When the given Quantity is more than 12, and contains any ſuch Number as can be found in the *Multiplication-Table*, then find any 2 Numbers, which, when multiplied together, will make the given Number; and then multiply the given Price by any one of thoſe Figures, and that Product multiply by the other Number, and that Product is the Anſwer. Thus, ſuppoſe I am to multiply by 15, I find 3 Times 5 is 15; therefore, I multiply by the 3 firſt, and ſet down the Product; then I multiply this Product by 5, and that gives me the Anſwer for 15; becauſe 3 Times 5, or 5 Times 3 make that Number. Again, ſuppoſe I were to multiply by 24, I find 4 Times 6 is 24; therefore, I firſt multiply by 4, and then multiply that Product by 6, which is the Anſwer: Or otherwiſe, as 3 Times 8 is 24, I may therefore multiply firſt by 3 and then by 8. So if the Number be 63, I find 7 Times 9, or 9 Times 7 is 63; therefore, I multiply the Price by any one of theſe Figures, and that Product I multiply by the other for the true Anſwer.

10. What coſt 15 Ells of Holland, at £. - 7 - 6 an Ell?
Here 3 Times 5 is 15, multiply firſt by 3

The Price of 3 Ells —— —— £. 1 - 2 - 6
Multiply by 5 —— —— —— 5

Price of 15 Ells —— —— £. 5 - 12 - 6 *Anſ.*

Work

Work at Length.

Firſt, I ſay 3 Six-pences is 1 *s.* 6 *d* that is 6 and I carry 1; then 3 Times 7 is 21, and 1 I carried is 22 Shillings, which is 1 *l.* 2 *s.* So is the Price of 3 Ells 1 *l.* 2 *s.* 6 *d.* Now I multiply this 1 *l.* 2 *s.* 6 *d.* by 5 (becauſe 5 Times 3 is 15) ſaying, 5 Times 6 is 30 Pence, is 2 *s.* 6 *d.* or 5 Six-pences is 2 *s.* 6 *d.* that is 6, and I carry 2; then 5 Times 2 is 10, and 2 is 12, which I ſet down *Laſtly,* I ſay, 5 Times 1 is 5; ſo the Anſwer for 15 Ells, at 7 *s.* 6 *d.* an Ell, is £. 5 - 12 - 6.

11. What coſt 24 Chaldrons of Coals, at } £. 1 - 11 - 6 a Chaldron?
4 Times 6 is 24, firſt multiply by 4

The Price of 4 Chald. 6 - 6 - 0
6 6

The Price of 24 Chald. £. 37 - 16 - 0 *Anſ.*

Proved another Way —— £. 1 - 11 - 6
3 Times 8 is 24, multiply by 3

Price of 3 Chald. 4 - 14 - 6
Multiply by 8 8

Price of 24 Chald. £. 37 - 16 - 0 as above

12. What coſt 35 Sheep, at £. 1 - 15 - 7 each?
5 Times 7 is 35, multiply firſt by 5

Price of 5 8 - 17 - 11
7 7

Price of 35 £. 62 - 5 - 5 *Anſ.*

13. What coſt 48 Load, at £. 3 - 10 - 6 a Load?
6 Times 8 is 48, multiply by 6

Price of 6 21 - 3 - 0
Multiply by 8 8

Price of 48 £. 169 - 4 - 0

14. What coſt 72 Pieces of Holland, at } £. 2 - 3 - 5 a Piece?
6 Times 12, or 12 Times 6 is 72, by 12

Price of 12 26 - 1 - 0
Multiply by 6 6

Price of 72 £. 156 - 6 - 0 *Anſ.*

15. What coſt 108 Quartern Loaves, at } £. 0 - 0 - $5\frac{3}{4}$ a Piece?
12 Times 9 is 108, multiply by 12

Price of 12 0 - 5 - $9\frac{0}{0}$
9 9

Price of 108 £. 2 - 11 - $9\frac{0}{0}$ *Anſ.*

Note 1. I have here indulged you with Cyphers, becauſe I would do every Thing that is eaſy to your Underſtanding; but really *Tyro*, it is better without them. Set down now 5 Pence 3 Farthings any where,

$5\frac{3}{4}$
12

- 5 - 9
9

£. 2 - 11 - 9 *Anſwer*

Note 2. This is the only Way, if you have a Mind to do Things quick, and off Hand; for tho' there be a Form in ſome Schools to the contrary, and you may hitherto have been inſtructed in that Way; yet, as I obſerved before, when you come to do a Sum, you are not bound to ſet it down in the very Form you were taught at School; for while you are doing *that*, another will anſwer the Queſtion over and over.

Tyro. I underſtand you Sir, very well, and thank you for your Care; but it is only Uſe, as you obſerved; for I think one full as eaſy as the other, and I grant it is much better for the quick diſpatching of Buſineſs.

16. What comes the Cloathing of 144 Soldiers to, at } £3 – 12 each Man?
12 Times 12 is 144, multiply by 12

12 coſt 43 – 4
12 again by 12

144 coſt £. 518 – 8 *Anſ.*

Tyro. You need not give me any more Examples: But pray, ſuppoſe the Quantity, or given Number, be ſuch as does not fall under, or cannot be found in the *Multiplication-Table*, ſuch as 17, 26, 38, 59, or the like; How then?

Philo. This is as eaſy as the other, as appears by the following Rule.

4. *Of Numbers that are not to be found in the* Multiplication-Table, *and how to work by them.*

Rule. When the given Number does not fall under the common Courſe of the Table, ſuch as 17, 38, 59, or the like; then take any two Figures that will come the neareſt to the Number (but not exceeding it) and work with them as in the former Examples, and then add the Price to that Product as many Times as there are odd Numbers, and the Work is done.

We will give you Examples of 17, 38, and 59.

17. What coſt 17 Groſs of Corks, at £. - 10 - 6½ a Groſs?

4 Times 4 is 16, and 1 is 17. Mult. by			4	
Price of	4	is	2 - 2 - 2	
	4		4	
Price of	16	is	8 - 8 - 8	
Add the Price of	1	Groſs, *viz.*	10 - 6½	
Price of	17	is	£. 8 - 19 - 2½	*Anſ.*

18. What coſt 38 Loads of Hay, at £. 1 - 11 - 6 a Load?

6 Times 6 is 36, and 2 is 38. Mult. by			6	
Price of	6	is	9 - 9 -	
	6	by	6	
Price of	36	is	56 - 14 -	
Mult. the Price 1*l.* 11*s.* 6. by	2	gives	3 - 3 -	add
Price of	38	is	£. 59 - 17 -	*Anſ.*

19. What is the Value of 59 Ports £. 1 - 16 - each

7 Times 8 is 56, and 3 is 59. Mult. by			7	
Value of	7	is	12 - 12 -	
	8	by	8	
Value of	56	is	100 - 16 -	
Then multiply 1*l.* 16*s.* by	3	is	5 - 8 -	add
Value of	59	is	£. 106 - 4 -	

This may be done another Way.

As you ſaid before, 7 Times 8 is 56, and 3 added made 59: So now you may ſay, 6 Times 10 is 60; and then take, or ſubtract the Value of 1 Piece of that Product, and the Anſwer will be the ſame as 59.

1 Port is			£. 1 - 16 -	
10 Times 6 is 60, firſt		by	6	
Value of	6	is	10 - 16 -	
	10		10	
Value of	60	is	108 - -	
Subtract	1	Piece, *viz.*	1 - 16 -	ſubtract
	59	*Anſ.*	£. 106 - 4 -	as above

Note 1. I have done this Sum 2 Ways for your Satisfaction; and you may in all ſuch like Caſes take which you like beſt: But as I obſerved before, it is better to take leſs, and then add the odd ones to that Sum, rather than to take more, and ſubtract from it.

Note 2. If you are perfect in what has already been ſhewn you, it will be very eaſy to perform any Sum in common Arithmetic, relating to Buſineſs, not only within the Compaſs of the Table, but in much larger Numbers. As for Inſtance; ſuppoſe it was required to tell the Value of 1000 Moidores: Or what will it coſt to cloath 1000 Men, at 1*l.* 7*s.* a Man? Here 10 Times 10 make 100, and 10 Times 100 makes 1000. Multiply therefore 1*l.* 7*s.* by 10; then that Product by 10; and this laſt Product by 10 will give the Anſwer, *viz.* £. 1350.

QUESTIONS *undone for Practice.*

1. What comes 33 Dozen of Candles to, at 4*s.* 9*d.* a Dozen? *Anſwer* £. 6 - 8 - 3 Multiply by 3, and then by 11.

2. How much is 46 Piſtoles, at 17*s.* 6*d.* each? Or what coſt 46 Pieces of *Iriſh*, at 17*s.* 6*d.* a Piece. *Anſwer* £. 40 - 5. Multiply by 5, then by 9, and add 17*s.* 6*d.* more for the odd 1.

3. What coſt 63 Barrels, at £. 1 - 5 - 9 a Barrel? *Anſ.* £. 81 - 2 - 3.

4. What comes 49 Months Salary to, at 3 Guineas a Month? *Anſ.* £. 154 - 7.

5. What comes 105 Gallons of Rum to, at 7*s.* 6*d.* ½ a Gallon? *Anſ.* £. 39 - 11 - 10½. 10 Times 10 make 100, and then multiply 7*s.* 6*d* ½ by 5, for the odd 5 Gallons, and add it to the laſt Product.

6 If I ſpend 1*d.* ¾, or 7 Farthings a Day, how much is that a Year, allowing 365 Days? *Anſwer* £. 2 - 13 - 2¾.

Firſt, 10 Times 10 make 100; then multiply the Anſwer of 100 by 3, it gives you the Expences of 300 Days, *viz.* 2*l.* 3*s* 9*d.* Now there are but 65 Days behind; therefore ſet down 7 Farthings in another Place, and multiply it by 8, and that Product multiplied by 8 again makes 64, and then add once 1*d.* ¾ for the odd Day, gives 9*s.* 5*d.* ¾ for the 65 Days, which added to the 300 Days, gives £. 2 - 13 - 2¾. *Secondly*, Or thus, which is ſhorter, 11 Times 11 is 121; then multiply the Product of 121 by 3, gives 363, and then add 2 Times 1*d*, ¾, *viz*, 3*d.* ½ to that Product, gives £. 2 - 13 - 2¾, as before.

As I have added the Anſwers to theſe Queſtions, I hope, *Tyro*, you will try to prove the Anſwers at large: For if you mind and make yourſelf Maſter of this Rule, you will be able to caſt up any common Thing, as quick, or quicker than by any other Method, and with far greater Eaſe.

As for *Croſs Multiplication*, *viz.* multiplying Money by Money, or Feet and Inches by Feet and Inches, it is better let alone for the preſent; therefore, we will proceed to *Diviſion.*

DIALOGUE V.

SECTION I.

Of DIVISION.

Tyro. WHAT is *Diviſion*, and what does it teach? *Philo.* *Diviſion* is juſt the Reverſe of *Multiplication*; for, as any Sum is encreaſed as many Times as the Figure you multiply by; ſo in *Diviſion*, the Number is decreaſed, or divided into as many Parts, as the Value of the Figures you divide by.

Tyro. What is to be learned, or obſerved in this Rule?

Philo. There are four Things very neceſſary to be known in *Diviſion*, *viz.*

Firſt, The *Dividend*, which is the Sum given to be divided.

Secondly, The *Diviſor*, or the Number you are to divide by.

Thirdly, The *Quotient*, or *Anſwer*, which ſhews you how many Times the *Diviſor* is contained in the *Dividend*: Or into how many Parts the *Dividend* is divided.

Fourthly, The *Remainder*, which is a fractional Part of the *Quotient*: But this does not concern you as yet.

Tyro. Am I to get this [illegible] Heart?

Philo. You are not [illegible] to get it juſt Word for Word; but you ſhoul[illegible]and well what the firſt 3 mean.

Tyro. Be ſo kind, Sir, as to explain them a little more for me.

Philo. Obſerve then: Let us take any two Numbers, ſuppoſe 24, and 6: Now 24 is the *Dividend*, and 6 is the *Diviſor*. Then I aſk how many Times 6 can I have in 24, and the Anſwer is 4; which 4 is called the *Quotient*. So alſo, ſuppoſe it was required to divide 108 by 12, or into 12 Parts, then every Part would be 9; for 12 Times 9 is 108. Now 108 is the *Dividend*, or Sum to be divided; 12 is the *Diviſor*, or what you divide by, and 8 is the *Quotient*.

Tyro Now Sir, I apprehend you quite well.

Philo. Then I will proceed to ſome Examples in ſingle Figures; but pray obſerve the following Rule.

1. *Of dividing by ſingle Figures in one Line only.*

Rule. Firſt, aſk how many Times the *Diviſor* is contained in the firſt Figure of the *Dividend*, and if the *Diviſor* be larger than the firſt Figure in the *Dividend*, then ſeek how many Times you can have it in the firſt two Figures of the *Dividend*, and ſet the Figure down accordingly: And if any Thing remains from the firſt Figure in the *Dividend*, carry it to the ſecond; and if any Thing remains in the ſecond Figure, carry it to the third; remembering always in this ſhort *Diviſion*, that if one remains you call it 10, if 2 remains you call it 20, if 5, 50, and ſo on; carrying the Remainder of one Figure to another in your Mind.

Note, To make the Work both ſhorter and eaſier, remember that 2's is read *Two's*, 3's is *Three's*, 5's is *Five's*, 12's is *Twelves*, and ſo for any other Figure: Thus, the 7's in 14, is read thus, the *Sevens* in 14; and the 6's in 24, is the *Sixes* in 24; which is the ſame as if I ſhould aſk, how many *Sixes* can I have in 24, but only ſhorter and more convenient.

An Example or two will, with Care, make it familiar to you.

Ex. 1.	*Dividend*	Ex. 2.	*Dividend*
Diviſor	3) 39	*Diviſor*	4) 168
Quotient	13 *Anſ.*	*Quotient*	42 *Anſ.*
	3		4
Proof	39	*Proof*	168

Now obſerve: In *Ex.* 1, I aſk how many *Three's* I can have in 3; or I ſay, the 3's in 3 is *once*; therefore I ſet down 1 under the 3 in the *Dividend*, and as there remains Nothing over, I aſk how many 3's I can have in 9; or I ſay, the 3's in 9 is 3 Times 3, and Nothing over; therefore, I ſet down 3 under the 9, and it is done. Again,

In *Ex.* 2. I ſay the 4's in 1 I can't have; but taking the next Figure to it, *viz.* 6, I ſay the 4's in 16 is juſt 4 Times; therefore, I ſet down 4 under the 6 in the *Dividend*, and as there is Nothing remains, I only ſay, the 4's in 8 is *twice*, therefore I ſet down 2 under the 8, and it is done. Now to prove it I multiply 42, the *Quotient*, by 4, the *Diviſor*, and find it 168 like the *Dividend*.

Ex. 3.	*Dividend*	Ex. 4.	*Dividend*
Diviſor	8) 37192	*Diviſor*	9) 245052
Anſwer	4649	*Anſwer*	27228
	8		9
Proof	37192	*Proof*	245052

Now obſerve, *Tyro*, In *Ex.* 3, I divide by 8, ſaying, the 8's in 3 I can't; but the 8's in 37 is 4 Times 8 is 32, and 5 over; I therefore ſet down 4 under the 7, and carry 5 to the next Figure, which is 1, which I now call

51; (for what you carry from one Figure you muſt always place before the next Figure) then I ſay the 8's in 51 is 6 Times 8 is 48, and 3 over; which 3 I now carry to the 9, and it is 39; therefore, I ſay the 8's in 39 is 4 Times 8 is 32, and 7 over; this 7 I now place before the 2, and it is 72; then I ſay the 8's in 72 is juſt 9 Times, and the Work is done. *To prove it*, I multiply the *Quotient* or Anſwer by the *Diviſor* 8, and find the *Product* the ſame as the *Dividend*. In *Ex*. 4, I ſay, the 9's in 2 I can't; but the 9's in 24 is 2 Times, or *twice* 9 is 18, and 6 over, which 2 I place under the 4, and carry 6 to the next Figure, which is 5, and call it 65; then I ſay the 9's in 65 is 7 Times 9 is 63, and 2 over, which 2 I place before the Cypher (0) and it is 20; then I ſay the 9's in 20 is *twice* 9 is 18, and 2 over, which I carry to the 5, and it is 25; then I ſay the 9's in 25 is *twice* 9 is 18, and 7 over, which I ſet before the laſt Figure 2, and it is 72; then I ſay the 9's in 72 is juſt 8 Times. *To prove it*, I multiply the *Anſwer* by 9, and the *Product* will be the ſame as the *Dividend*.

EXAMPLE 5.

Divide by 7)417296

Anſwer 59613–5*
7

Proof 417296

EXAMPLE 6.

Divide by 9)9471636

Anſwer 1052404
9

Proof 9471636

* Here in *Example* 5, there is 5 remains at laſt; therefore, I ſet it at the End of the Anſwer, parting it with a Stroke, thus, –5; and when I prove the Work I multiply by 7, and take the Remainder 5 in, ſaying, 7 Times 3 is 21, and 5 is 26, 6 and I carry 2, &c.

	EXAMPLE 7.		EXAMPLE 8.
	8)716206		5)12631908
Anſwer	89525-6	*Anſwer*	2526381-3
	8		5
Proof	716206	*Proof*	12631908

More Examples for Practice.

7)697220716	9)407217943

Tyro. I underſtand what you have ſhewn me very well; but pray, before you come to long *Diviſion*, give me an Example at large to divide by *Twelve* the ſhort Way.

Philo. I will: Let it be required to divide 14799906 by 12. I ſet it down thus:

EXAMPLE 11.	EXAMPLE 12.
12)1479908	12)59904965
123325-8	4992080-5

Here I divide by 12, ſaying, the 12's in 14 is *once* 12, and 2 over, and this 2 I carry to the 7 and it is 27; then I ſay the 12's in 27 is *twice* 12 is 24, and 3 over, that is 39; then I ſay the 12's in 39 is 3 Times 12 is 36, and 3 over, that is 39 again; therefore, I ſet down another 3, and carry the 3 that is over to the next Figure, which is a Cypher, calling it 30; then I ſay the 12's in 30 is *twice* 12 is 24, and 6 over, which is 68; now the 12's in 68 is 5 Times 12 is 60, and 8 over, which I place after the Sum, thus, -8, and it is done.

In *Ex.* 12. I ſay the 12's in 6 I can't; but the 12's in 59 is 4 Times 12 is 48, and 11 over, which 11 carried to, or joined to the next Figure 9 is 119; then I ſay the 12's in

119

119 is 9 Times 12 is 108, and 11 over again, which I now carry to, and join to the next Figure 0, and call it 110; then ſay the 12's in 110 is 9 Times, and 2 over, which 2 I join to, or carry to the 4, and it is 24: Now the 12's in 24 is juſt *twice*, and Nothing over; therefore I now begin a-freſh at the 9, ſaying, the 12's in 9 I can't, but the 12's in 96 is juſt 8 Times: *Laſtly*, I ſay, the 12's in 5 I can't have; therefore, I ſet down a Cypher under the laſt Figure 5, and drawing a ſhort Line, ſet the 5 that remains after it, thus, –5.

Now, *to prove it*, I multiply back by 12, and take in the 5, ſaying, 12 Times 0 is 0, but 5 is 5; then 12 Times 8 is 96, 6 and I carry 9, *&c.* till I go through the Whole.

☞ *Note*, *Multiplication* is an infallible Proof for *Diviſion*; for if you multiply the *Quotient* by the *Diviſor*, you will have the ſame Figures as are in the *Dividend*, always remembering to take in the Remainder with the firſt Figure you begin to multiply.

Tyro. I humbly thank you, Sir; I am quite ſatisfied with what you have ſhewn me; and now, if you pleaſe, I ſhall be obliged to you to ſhew me how to divide by ſeveral Figures.

Philo. You will ſoon learn it with Care: You muſt note there are 3 or 4 Ways to work *Diviſion*; but as my Intent is not for Curioſity, but Improvement, I ſhall only ſhew you that Method which is moſt *natural* and *practicable*; you may at any Time learn the reſt.

2. *Of dividing by 2, 3, or more Figures.*

Rule. Firſt *ſeek*, or aſk how many Times the Figures in the *Diviſor* are contained in the ſame Number of Figures in the *Dividend*, and put that Figure in the *Quotient*. *Secondly*, *Multiply* now the *Diviſor* by the ſaid Figure in the *Quotient*, and place it under thoſe Figures in the *Dividend* that you began to work with, always obſerving, that the *Product* be not larger than the Figures in the *Dividend*; for if they are, you muſt rub out, or cancel the Figure in the *Quotient*, and put one of a leſs Denomination. *Thirdly*, This being done, *ſubtract* now the *Product* from that Part of the *Dividend* it ſtands under, and to the Remainder bring down the next Figure in the *Dividend*, placing, or joining it to the laſt Figure of the *Remainder* Then *ſeek* how many Times the *Diviſor* is contained in theſe Figures; then multiply the *Diviſor* by the ſaid Figure; then *ſubtract* again; and *laſtly*, bring down the next Figure in the *Dividend*, as before; and thus proceed till you have no more Figures in the *Dividend* to bring down, and the Work is done.

☞ *Note* 1. Every Time you *ſubtract*, obſerve whether the *Remainder* be larger than the *Diviſor*; for if it be, you muſt put a larger Figure in the *Quotient*.

Note 2. Whenever you take a Figure down from the *Dividend*, and join it to the *Remainder*, and that is ſtill leſs than the *Diviſor*; then always put a Cypher in the *Quotient*, and bring down another Figure of the *Dividend*. An Example or two at large will make it eaſier.

EXAMPLE I.

```
            Dividend
Diviſor 15)19260(1284 Quotient
           15         or Anſwer
           ——                      Quotient  1284
            42                     multiply  by  15 Diviſor
            30                               ————
            ——                               6420
            126                              1284
            120                              ————
            ———                    Product  19260 Dividend
              60
              60
              ——
               0
```

Now obſerve: Having 2 Figures in the *Diviſor*, I aſk how many Times they are contained in the 2 firſt Figures of the *Dividend*, (*viz.* 19) and find it *once*; therefore I ſet 1 in the *Quotient*. *Secondly*, I multiply the *Diviſor* 15 by 1, ſaying, *once* 5 is 5, *once* 1 is 1, and place it under the 19. Then, *Thirdly*, *Subtract* 15 from 19, and there remains 4; and *laſtly*, I bring down the next Figure in the *Dividend* (*viz.* the 2) and join it by the Side of the *Remainder* 4, and it is 42; and now I begin as at the firſt, and aſk how many Times 15 are contained in 42, and find it *twice*; therefore, I ſet down 2 in the *Quotient:* Then I multiply the *Diviſor* 15 by 2, which is 30, and place it under 42; this done, I *ſubtract* 30 from 42, and there remains 12; and then again, I bring down the next Figure of the *Dividend* (*viz.* 6) and place it by the Side of 12, and it is 126. Then I aſk how many Times 15 I can have in 126, and find it 8 Times; therefore, I put an 8 in the *Quotient*, and multiply 15 by it, which is 120, which I place under 126. Then I *ſubtract* 120 from 126, which is 6, and bring down the laſt Figure in the *Dividend*, which is a Cypher (0) and it makes 60; then I ſeek how many Times 15 I can have in 60, and find it 4 Times; then I multiply 15 by 4, and find it juſt 60, which I place under the other 60, and the Work is done.

RULE 2.

Note 1. When there are ſeveral Figures in the *Diviſor*, it is eaſier for a Learner to aſk how many Times the firſt Figure of the *Diviſor* is contained in the firſt Figure of the *Dividend*, and place the Times in the *Quotient*; then multiply the whole *Diviſor* by the *Quotient* Figure, and if the Product be more than the Figures which belong to the *Dividend*, you muſt make Trial of a leſs Figure, and put it in the *Quotient*.

Note 2. If the firſt Figure of the *Diviſor* be larger than the firſt Figure in the *Dividend*, then take 2 Figures in the *Dividend*, and ſeek how many Times the firſt Figure of the *Diviſor* is contained in them.

Note 3. You muſt remember, that in making Trial how often the firſt Figure in the *Diviſor* is contained in two Figures of the *Dividend*, it will ſometimes appear to be 10, or 12 Times; but obſerve, it never can be above 9 at moſt, and oftentimes not ſo many as it appears to be.

The ſame Example further demonſtrated.

Let it be required to divide 19260 by 15?

Firſt, I ſet the *Dividend* down on a Slate, and make a Couple of crooked Lines at the Ends of it, in the firſt of which I place the *Diviſor*, thus, 15)19260(and the other is to place the *Quotient* in.

Secondly, I aſk how many Times the firſt Figure of the *Diviſor* is contained in the firſt Figure of the *Dividend*, and find it *once*, therefore, I place a 1 in the *Quotient*, and multiply the whole *Diviſor* by it, and place the Product under the two firſt Figures of the *Dividend*, and ſubtract it therefrom, and it will ſtand thus:

Second Work.

```
           15)19260(1
              15·
              ----
    Remains   42
```

Thirdly, To this Remainder 4 I bring down the next Figure, *viz*. 2, (always making a Dot under the Figure I bring down) and it is 42; then I aſk how often the firſt Figure 1 in the *Diviſor* is contained in 4, and it is 4 Times; but upon Trial, I find 4 Times 15 is 60, therefore, as 60 is more than 42, I muſt take a leſs Figure; I therefore make Trial of a 2, and find twice 15 is 30; which I place under 42, and ſubtract it, and there remains 12, which ſtands thus:

Third Work.

```
  15)19260(12
     15··
     ----
      42
      30
     ----
Remains 126
```

Fourthly, I now make a Dot under the 6, and bring it down by the Side of the 12, and it is 126; then I aſk how many of the firſt Figures of the *Diviſor* I can have in the firſt two Figures of the *Dividend*, and find it 12 Times; but according to *Note* 3, it never goes above 9 Times; therefore, I multiply 15 by 9, and it is 135: Now I can't take 135 out of 126, therefore 9 Times is too much, and I make Trial of a leſs Figure, to wit, 8, which I put in the *Quotient*, and multiply 15 by it, which is 120, and place it under 126, and there remains 6, which ſtands thus:

Fourth Work.

```
  15)19260(128
     15···
     -----
      42
      30
     -----
      126
      120
     -----
Remains 6
```

Laſtly, I make a Dot under the Cypher (0) and bring it down by the Side of the 6, thus, 60; then I aſk how many Times the firſt Figure of the *Diviſor* is contained in 6, or the *Ones* in 6 is 6 Times; but upon Trial, I find it will go but 4 Times; therefore, I place a 4 in the *Quotient*, and multiplying 15 by it, find it to be 60, which I place under the other 60, and there remains 0, and the Work is done, as under.

Laſt Work.

```
Diviſor 15)19260(1284 Quotient
           15...                    Proof
           ----                      1284 Quotient
            42                         15 Diviſor
            30                       ----
           ----                      6420
           126                       1284
           120                       ----
           ----              Product 19260 Dividend
             60
             60
           ----
              0
```

☞ *Note*, The Reaſon of making Dots under every Figure you take down, is becauſe you may not miſtake which Figure comes next in Courſe; but when you are quite perfect you need not trouble yourſelf with them.

Tyro. This is a plain Demonſtration, and I ſee now the Manner of working *Diviſion*, though, I own, I am not perfect yet.

Philo. I ſhall give you an Example or two more then, and ſhew you at the ſame Time how to prove it by *Addition*.

EXAMPLE. 2.

```
Divide by 375)24172196(64459 Anſ.
             *2250····
             --------
              1672
             *1500                64459
             --------               375
              1721               --------
             *1500               322295
             --------           451213
               2219            193377
              *1875            --------
             --------          24172125
               3446                  71 add Rem.
              *3375            --------
             --------          24172196 Proof
Remains          *71
             --------
Proof        24172196
```

The PROOF.

This Example is proved the ſame as the laſt, by multiplying the *Quotient* by the *Diviſor*, and afterwards adding the *Remainder* to it.

PROOF *by* ADDITION.

Though *Multiplication* be an infallible Proof of *Diviſion*, yet in large Sums, *Addition* is much ſhorter and eaſier, and when the Work is right, is as infallible as the other. If indeed it be objected, that a Boy may *vamp*, or alter the Figures (as in proving *Multiplication* by the Croſs) in Order to make the Sum come right, there is the ſame Reaſon to ſuppoſe (without his Maſter's Inſpection) that he may alter his *Multiplication* Sum, when he comes to add it up, that it may fall right with the

Dividend. Beſides, as in the very Work of every *Diviſion* Sum, the *Diviſor* is naturally multiplied into every Figure of the *Quotient*, what need it to be done again? And I perſuade myſelf, that thoſe Maſters that have made Uſe of this Method of proving *Diviſion*, will acknowledge, that it is not only much eaſier to the Scholar, but alſo much more improving; becauſe he muſt ſet his Figures in Order, right under one another, or elſe he will be puzzled to add the Sum up: He cannot therefore avoid improving himſelf (in ſome Meaſure) by this Method.

To prove Diviſion *by* Addition.

Rule. Add the Remainder of all the different Products of the *Diviſor* together, in Order, as they ſtand, and their Sum will be the ſame as the *Dividend.* Or thus: Add the Remainder (if any) and all the lower Lines together in Order, as they ſtand, and you will find their Sum the ſame as the *Dividend,* if the Work be right.

Note, In *Example* 2, I have made Stars (thus *) againſt thoſe Figures which are to be added together; which you ſee is the lower Row of the two; for the Top Row is never added.

Two Examples, with their Proofs.

EXAMPLE 3.

Divide by 5267)821695074(156008 *Anſwer*

*5267·····

29499

*26335

31645

*31602

43074

*42136

Remains *938

Proof 821695074

EXAMPLE 4.

Divide by 9758)94076257(9640 *Anſwer*

*87822··

62542

*58548

39945

*39032

Remains *9137

Proof 94076257

Here in the firſt Example, I take all the lower Lines of the two, againſt which this Mark (*) is placed, and beginning at the Remainder, I ſay 8 and 6 is 14, 4 and I carry

I carry 1, to 3 is 4, and 3 is 7; then 9 and 1 is 10, that is 0, and I carry 1, to 2 is 3, and 2 is 5; then 4 and 5 is 9, then 6 and 3 is 9, and 7 is 16, 6, and I carry 1, to 1 is 2, and 3 is 5, and 6 is 11, that is 1, and I carry 1, to 3 is 4, and 6 is 10, and 2 is 12, that is 2, and I carry 1, to 2 is 3, and 5 is 8. And thus you may proceed to prove the other Example.

Tyro. I confeſs I could not have thought it had been ſo eaſy; and it is (in Effect) proving of it by *Multiplication*, as you obſerved.

Philo. I am glad you underſtand it; and I hope you will take ſuch Care as to have no Occaſion to prove the Work at all. Perſons in Buſineſs, *Tyro*, cannot go thro' theſe Forms; if they ſuſpect they have done wrong, they look over the Work a ſecond Time, and that is a ſufficient Proof in general.

Of CONTRACTIONS.

Tyro. What is the Uſe of *Contractions*?

Philo, When the *Diviſor* conſiſts of ſeveral Cyphers after a Figure, or Figures, then cut them all off, or ſeparate them from the Figures with a Daſh of your Pen or Pencil; and alſo remember at the ſame Time to cut off as many Cyphers, or Figures in the *Dividend*; then work the Sum as if ſuch Cyphers never had been there at all, and you will have the ſame Anſwer.

Ex. 1.	Ex. 2.	Ex. 3.
1|000)9250|000	4|00)5476|00	12|00)54762|000
9250 *Anſ.*	1369 *Anſ.*	*Anſ.* 4563—6

Here I cut off all the Cyphers in the *Diviſor*, and as many Cyphers in the *Dividend*, and divide only by the ſingle Figures, and if any Thing remains, I ſet it after it. As in *Example* 3, there is 6 remains, which I ſet after the Anſwer, thus, —6.

Tyro. This is eaſy enough; and now, if you pleaſe, I ſhall be glad to know what you mean by *Diviſion of Parts.*

SECTION II.

DIVISION *of Parts.*

Philo. D*IVISION of Parts* is the dividing by any two ſingle Figures in their Parts, which 2 Figures multiplied together will be equal to the *Diviſor.*

Tyro. I do not rightly apprehend you.

Philo. You remember, *Tyro*, in *Queſtions* of *Multiplication*, that when any Number was given in the Table, you found two ſuch Figures, which, when multiplied together, would make that Number; ſo here alſo you do the ſame, only with this Difference, that you here divide by them inſtead of multiplying. Thus, ſuppoſe I was to divide by 24, by 32, by 48, or by 72, I firſt divide by 3, then by 8; for 3 Times 8 is 24, and the laſt Quotient is the Anſwer. So if I divide by 48, I divide the Number firſt by 8, and then that *Quotient* I divide by 6, and have the proper Anſwer, *&c.*

EXAMPLE I.

Divide 16488 *by* 24. Here 6 Times 4 is 24.

Firſt by 6) 2748 *Quotient by* 6

Then by 4) 687 *Quotient by* 24

Ex-

EXAMPLE 2.

Divide 126216 *by* 72. 6 Times 12 is 72.
Firſt by 6) 21036 *Quotient by* 6
Then by 12) 1753 *Quotient by* 72

Tyro. I underſtand you; this is only then the Reverſe of *Multiplication.*

Philo. Nothing more, as you may more plainly ſee by what follows.

2. *Of dividing* MONEY.

Diviſion of Money is juſt the Reverſe of *Multiplication of Money*; for as in *Queſtions* of *Multiplication*, the Money is encreaſed ſo many Times, according to the given Number; ſo here the Money is decreaſed, or divided into as many Parts as the given Number is.

It will be eaſier to your Comprehenſion to take an Example in *Multiplication*, and prove it by *Diviſion.*

If 1 Ell coſt £. 1 – 3 – 8 What coſt 40 Ells?
8
8 9 – 9 – 4
5 5
40 £. 47 – 6 – 8 *Anſ.*

PROOF *by* DIVISION.

1 If 40 Ells coſt £. 47 – 6 – 8, what coſt 1 Ell?

Here I divide back by the ſame Figures I multiplied by, carrying the Pounds to the Shillings, and the Remainder of the Shillings to the Pence, doing by *Twenties*, and by *Twelves*, as in *Addition.*

by 5)£47 - 6 - 8

Then by 8) 9 - 9 - 4 Price of 8

£.1 - 3 - 8 Price of 1 *Anſ.*

Here I divide firſt by 5, ſaying, the 5's in 47 is 9 Times 5, and 2 over, which is £.2; this £.2 I carry to the 6 *s.* and it is £. 2 - 6, or 46 *s.* then I ſay the 5's in 46 is 9 Times 5 is 45, and 1 over, that is 1 Shilling, which I carry to the 8 Pence, and it is 1 *s.* 8 *d.* or 20 Pence, then I ſay the 5's in 20 is 4 Pence. Now I divide this £.9 - 9 - 4 by 8, ſaying, the 8's in 9 is *once*, and £. 1 over, which I carry to the 9 Shillings, and it is £.1 - 9, or 29 Shillings; then I ſay, the 8's in 29 is 3 Times 8 is 24, and 5 Shillings over, which I carry to the Pence, and it is 5 *s.* 4 *d.* or 64 Pence; then I ſay the 8's in 64 is 8 Times. So is the Price of 1 Ell £.1 - 3 - 8; as appears alſo by the Work of *Multiplication.*

EXAMPLE 2.

Suppoſe £.88 - 4 - 0 be divided among 56 poor Widows, how much is the Share of each?

by 7)£88 - 4 - 0 Here 7 Times 8 is 56.

by 8)12 - 12 - 0 Share of 8

Anſ. 1 - 11 - 6 Share of each

If you underſtand the Nature of multiplying any Sum by any Figure, you ſee you may as readily divide it back again.

Tyro. Sir, I ſee the Way of working it very plainly. Have you any Thing farther to add.

Phil. Nothing more, as you ſay you are perfect; only ſome Queſtions for to exerciſe you.

3. QUESTIONS

3. QUESTIONS *to exerciſe* DIVISION.

1. Divide 822306485 by 1715. *Anſ.* 479479.

2. Divide 150348045 by 285. *Anſ.* 527537.

3. Divide 47198714 by 6357. *Anſ.* 7424, and 4346 remains.

QUESTIONS *in* MONEY.

1. Divide 1 *l.* 16*d.* 8*d.* into 5 Parts. *Anſ.* 7*s.* 4*d.*

2. Divide 4 *l.* 8 *s.* 1 *d.* $\frac{1}{2}$ into 9 Parts. *Anſ.* 9 *s.* 9 *d.* $\frac{1}{2}$.

3. Divide 25 *l.* 5 *s.* 4*d.* into 32 Parts. *Anſ.* 15 *s.* 9*d* $\frac{1}{2}$.

4. A Gentleman left by Will 100 Pounds among 3 Score (or 60) poor Perſons, to be paid every *Chriſtmas-Day*; how much is each to receive?

I leave this laſt Queſtion wholly for the Learner to do. And now, *Tyro*, you are come to that Rule, in which you will exerciſe all the other *Four*; therefore, if you be not perfect, you will be at a Loſs very often.

DIALOGUE. VI.

SECTION I.

Of REDUCTION.

Tyro. WHAT is *Reduction*, and what does it teach?

Philo. *Reduction* is a Rule compounded of all the foregoing Rules; being a proper Exerciſe for the better perfecting you in them. It teaches to *reduce* Things of one Denomination into another, and is of excellent Uſe in common Affairs of Life.

Tyro. How many Parts is this Rule divided into?

Philo. Two. 1. *Reduction aſcending.* 2. *Reduction deſcending.*

Tyro. What do you mean by *Reduction aſcending.*

Philo. *Reduction aſcending* is when Things of a *ſmall* are *reduced*, or *brought* into Things of a *greater* Denomination; as Farthings into Pence, Pence into Shillings, Shillings into Pounds, or Ounces into Hundred Weights: And *this* remember is done by *Diviſion* only, by dividing by as many of the *leſs*, as make one of the *greater* Denomination.

Tyro. What do you mean by *Reduction deſcending.*

Philo. *Deſcending* is juſt the Reverſe of the other; for by *Reduction deſcending*, Things of a *great* are *reduced* or *brought* into Things of a *leſs* Denomination; as Pounds into Shillings, Shillings into Pence, or Farthings; *Cwts.* into Pounds, Tons into Quarters, Miles into Yards, Yards into Inches, and the like; and *this* remember is always done by *Multiplication* only, by multiplying the *greater* Denomination by as many as it contains of the *leſs* Denomination.

Tyro. Then I find *Reduction deſcending* is the eaſier of the two, as it is performed by *Multiplication* only.

Philo. It is ſo: And that is the Reaſon it is commonly taught firſt.

Note, I ſhall prove every Sum of *Reduction deſcending* by *Reduction aſcending*, and then you will ſee the Nature of both.

1. *Of* REDUCTION deſcending.

Tyro. How do you ſay this is performed?

Philo. By this Rule. *Multiply every Denomination by as many as the next leſs Denomination contains, and you have the Anſwer, which is called* Reduction deſcending. Then to prove the Work, *divide back by the ſame Figures you multiplied by, and this is called* aſcending.

A few Queſtions will make it plain to you.

Queſt. 1. In 12 Pounds how many Shillings?

£. 12
Multiply by 20 Shillings in a £.

Anſ. 240 Shillings

PROOF *aſcending.*

In 240 Shillings how many £. *Sterling?*
Here I divide back by 20, as before I multiplied.

2|0)24|0 Shillings

£. 12 *Anſw.*

Here I cut off the Cyphers in the *Diviſor* and *Dividend* with a Daſh of my Pen, and divide by 2 only, and the Anſwer is 12.

Queſt. 2. In £. 23 – 14 *s.* how many Shillings and Pence.

£. 23 – 14
Firſt by 20 and take in the 14.

474 Shillings
Then by 12

5688 Pence.

PROOF.

In 5688 Pence how many Shillings and £'s *Sterling.*
Divide by 12)5688 Pence

Then by 2|0)47|4 Shillings

£. 23 – 14 as above

Here I divide by 12, and it brings the Pence into Shillings; then I divide by 20, cutting off the Cypher, and cutting off the 4 alſo: Then I divide by 2 only, ſaying, the 2's in 4 is *twice*, the 2's in 7 is 3 Times 2 and 1 over, which 1 I place before the Figure 4, that I alſo cut off, and it is 14 Shillings.

This is a *general Rule*; obſerve, that when you cut off any Figure, or Figures, what remains in dividing muſt be placed before them, and is the true Remainder.

Tyro. This is very plain I own.

Philo. Then we will proceed to *Queſtion* 3.

Queſt. 3. In £. 45 – 17 – 6¾ how many Shillings, Pence, and Farthings?

£. 45 – 17 – 6¾
by 20

917 Shillings
by 12

11010 Pence
by 4

Anſ. 44043 Farthings

Here I multiply £. 45 by 20, and take in the 17 Shillings, ſaying, 0 is 0 but 7 is 7; then twice 5 is 10, and the 1 by the Side of the 7 Shillings is 11, that is 1, and I carry 1; then twice 4 is 8, and 1 is 9, which is 917 Shillings. Again, I multiply the Shillings by 12, and take in the odd Six-pence; and *laſtly*, I multiply the Pence by 4, and take in the odd 3 Farthings, ſo is the Work done.

PROOF *by* Reduction aſcending.

In 44043 Farthings, how many Pence, Shillings, and Pounds *Sterling?*

Here I divide only back by the ſame Figures I multiplied by, and it is done.

Divide by 4)44043 Farthings

by 12)11010 Pence, and 3 Farthings over

by 2|0) 91|7 Shillings, and 6 Pence over.

£. 45 - 17 - 6¾ as above.

Tyro. I underſtand it very well indeed.

Philo. Then I need not inſtruct you any more till ſome Difficulty offers.

Queſt. 4. In £99 - 19 - 11 ¾, how many Shillings, Pence, and Farthings?

£. 99 - 19 - 11¾
Multiply by 20

1999 Shillings
by 12

23999 Pence
by 4

95999 Farthings

In 95999 Farthings, how many Pence, Shillings, and Pounds?

Divide by 4)95999 Farthings

by 12)23999—3

by 2|0) 199|9—11

£.99 - 19 - 11$\frac{3}{4}$

5. In 30 Guineas, how many Shillings and Pence?

30 Guineas
21 Shillings make 1 Guinea

30
60

630 Shillings
12

7560 Pence

PROOF.

In 7560 Pence, how many Shillings, and Guineas?

12)7560 Pence

21) 630(30 Shillings *Anſ.*
63

00

And thus you ſee, *Tyro*, that any Sum, of any Name or Denomination, may be reduced to another.

Queſt. 6. In £. 472 - 15 Shillings, how many Crowns, Shillings, Groats, and Pence?

	£: 472 - 15	
Multiply by	4	the Crowns in a £. and count the 15 *s.* for 3 Crowns, ſaying, 4 Times 2 is 8, and 3 is 11.
Crowns	1891	
	5	Shillings 1 Crown
Shillings	9455	
	3	Groats 1 Shilling
Groats	28365	
	4	Pence is 1 Groat
Pence	113460	*Anſ.*

PROOF.

In 113460 Pence, how many Groats, Shillings, and Pounds?

Divide by 4)	113460	Pence
by 3)	28365	Groats
by 5)	9455	Shillings
by 4)	1891	Crowns
	£. 472—3 Crowns over, *viz.* 15 Shillings, as above.	

Note 1. To bring Pounds into Pence at one Operation, *multiply by* 240, becauſe 240 Pence make 1 Pound. To bring Pounds into Farthings at one Operation, *multiply by* 960, the Farthings in a Pound. On the contrary, *Note* 2. To bring Pence into Pounds, *divide by* 240. To bring Farthings into Pounds, *divide by* 960.

AVOIRDUPOIS-WEIGHT.

Queſt. 7. In 17 *C.* 3 *qrs.* 15 *lbs.* how many *Cwt.* *qrs.* and *lbs.*

C. *qr.* *lb.*
17 - 3 - 15
by 4 *qrs.* make 1 *Cwt.*

71 *qrs.*
by 28 *lb.* 1 *qr.*

573
143

2003 *lbs.* *Anſ.*

Here I multiply by 4, and take in the odd 3 Quarters; then I multiply by 28, and take in the odd 15 Pounds, and the Work is done.

PROOF.

In 2003 Pounds Weight, how many Quarters of Hundreds, and Hundred Weight?

28)2003(71 *qrs.*
196

43
28

15 *lb.* over

qrs. *lb.*
4)71 - 15

17 - 3 - 15 as before
C. *qr.* *lb.*

Queſt. 8. In 17 C. 3 *qrs.* 15 *lb.* how many *qrs. lbs.* and *oz.*

C. *qrs.* *lb.*
17 – 3 – 15
by 4

71 *qrs.*
28

573
143

2003 *lb.* *
16

12018
2003

32048 *oz. Anſ.*

Note, The following Method is very uſeful in many Caſes to reduce Hundred Weights into Pounds, being both ſhort and expeditious, *viz.*

* Set down the Hundreds 4 Times under one another in the following Manner, and add the odd Pounds beſides, gives the Anſwer.

17 *Cwt.*
17
17
17
99 *lb.* in 3 *qrs.* 15 *lb.*

2003 *lb.* *

PROOF.

In 32048 Ounces, how many *lbs. qrs.* and *Cwt.*
Divide this back again by 16, 28, and 4, and you will have 17 C. 3 *qrs.* 15 *lb.*

TROY.

TROY-WEIGHT.

Queſt. 9. In 5 *lb.* 2 *oz.* 14 *dwts.* of Silver, how many *oz.* *dwts.* and *grs.*

lb. *oz.* *dwts.*
5 – 2 – 14
12 *oz.* 1 *lb.* *Troy by* 12 and take in 2 *oz.*
62 *oz's.*
20 *dwts.* 1 *oz.* *by* 20 and take in 14 *dwts.*
1254 *dwts.*
24 *grs.* 1 *dwt.* *by* 24
5016
2508
30096 Grains *Anſ.*

PROOF.

Divide back by the ſame Figures, 24, 20, and 12, and have a Regard to the Remainder, you'll find it 5 *lb.* 2 *oz.* 14 *dwts.* Do you now underſtand what has been ſhewn you?

Tyro. I do very well; and I can ſee that *Reduction aſcending* is only the Proof to the other, and that they prove one another in every Reſpect.

Philo. If you are perfect in what I have ſhewn you, there is no Occaſion to run through all the Weights and Meaſures, for they are done after the ſame Manner.

Tyro. I know it, Sir; but every Example is a freſh Encouragement.

Philo. True; and I am as ready to give them.

DRY-MEASURE.

Queſt. 10. In 14 Loads, 15 Buſhels, how many Buſhels, and Pecks.

L. *B.*
14 – 15
40 Buſhels 1 Load, *mult. by* 40 and take in the 15 Buſh.
575
4 Pecks 1 Buſhel
2300 Pecks *Anſ.*

PROOF.

In 2300 Pecks, how many Buſhels and Loads? Divide 2300 by 4, and that Quotient divide by 40, and 15 will remain; which is 14 Loads, 15 Buſhels.

LIQUID-MEASURE.

Queſt. 11. In 12 Hogſheads of Wine how many Gallons and Pints?

12 Hogſheads
by 63 Gallons in 1 Hogſhead of Wine
36
72
756 Gallons
by 8 Pints 1 Gallon
6048 Pints *Anſ.*

PROOF.

PROOF.

In 6048 Pints how many Gallons and Hogſheads? Divide this back again by 8, and by 63, and you will have juſt 12 Hogſheads.

BEER-MEASURE.

Queſt. 12. In 18 Butts of Beer how many Hogſheads and Gallons?

18 Butts
by 2 Hogſheads 1 Butt.

36 Hhds.
by 54 Gallons 1 Hogſhead of Beer.

144
180

1944 Gallons *Anſ.*

PROOF.

In 1944 Gallons of Beer, how many Hogſheads and Butts? *Anſ.* 18 Butts.

CLOTH-MEASURE.

Queſt. 13. In 26 Yards, 3 Quarters, how many Quarters and Nails?

Yards qrs.
26 – 3
by 4 Quarters 1 Yard, and take in the 3 *qrs.*

107 *qrs.*
by 4 Nails 1 *qr.*

428 Nails

PROOF.

In 428 Nails, how many Quarters and Yards?
Divide 428 by 4, and then by 4 again. *Anſ.* 26 Yards, 3 qrs.

Note, This, and the two following Queſtions, are of great Service in the *Rule of Three direct*; where it is often required to reduce Yards and Ells into Quarters, and the contrary.

Queſt. 14. In 26 Ells *Engliſh*, 3 Quarters, how many Quarters and Nails?

Ells qrs.
26 – 3
by 5, and take in 3 qrs. 5 qrs. 1 Ell *Engliſh.*

133 qrs.
by 4 Nails 1 qr.

532 Nails

PROOF.

In 532 Nails, how many Quarters and Ells *Engliſh?*
Divide 532 by 4, and by 5, you'll have 26 Ells *Engliſh*, 3 qrs.

Queſt. 15. In 26 Ells *Flemiſh*, 2 Quarters, how many Quarters and Nails?

Ells Fl. qrs.
26 – 2
by 3 qrs. 1 Ell *Flemiſh*, take in 2 qrs.

80 qrs.
by 4 Nails 1 qr.

320 Nails. *Anſ.*

PROOF.

PROOF.

In 323 Nails, how many Quarters, and Ells *Flemiſh?* Divide 320 by 4, and by 3, you'll have 26 Ells *Flemiſh*, 2 qrs.

LONG-MEASURE.

Queſt. 16. In 927 Miles, how many Yards, Feet, and Inches?

927 Miles
In 1 Mile are 1760 Yards

55620
6489
927

1631520 Yards
3 Feet 1 Yard

4894560 Feet
12

58734720 Inches

PROOF.

In 58734720 Inches, how many Feet, Yards, and Miles.

Divide back by the ſame Figures, you'll have at laſt 927 Miles.

Note, I ſhall give you a fuller Example in this Rule, when we come to *Compound Reduction*, there being *Diviſion* required when you are to bring Rods into Yards.

LAND-MEASURE.

Queſt. 17. In 54 Acres, how many Roods and Poles?

54 Acres
4 Roods 1 Acre, *by* 4
216
40 Rods 1 Rood, *by* 40
Rods 8640

or multiply 54 by 160, the Rods in an Acre, gives 8640 Rods.

PROOF.

In 8640 Rods or Poles, how many Acres?

Divide by 40, and then by 4, or divide 8640 by 160, and it gives 54 Acres.

SQUARE-MEASURE.

Queſt. 18. In 217 Square Yards, 5 Feet, how many Square Feet, Inches, and Square Quarters?

Square Yards Feet
217 – 5
9 Square Feet 1 Yard, *by* 9
1958 Square Feet
144 Inches 1 Foot 144
7832
7832
1958
281952 Square Inches
16 Square qrs. 1 Inch 16
1691712
281952
4511232 Square Quarters.

PROOF.

PROOF.

In 4511232 Square Quarters, how many Square Inches, Feet, and Square Yards.

Divide this Number back by 16, you have Square Inches; then by 144, you have Square Feet, and *laſtly*, by 9, you'll have 217 Yards, 5 Feet.

Note, That 12 Times 144, or 1728 ſolid Inches, make a *ſolid Foot*; ſo that you are to multiply *ſolid Feet* by 1728, to bring them into *ſolid Inches*, and on the contrary, to bring ſolid Inches into *ſolid Feet*, you muſt *divide* by 1728.

TIME.

Queſt. 19. How many Days, Hours, Minutes, and Seconds are expired ſince the Birth of our Lord and Saviour, *Jeſus Chriſt*, ſuppoſing it 1752 Years, 217 Days, 17 Hours, and 35 Minutes, and allowing juſt 365 Days to a Year.

Years *Days* *Hours* *Min.*
1752 – 217 – 17 – 35
Days in a Year, *by* 365 take in 217, ſaying, 5 Times 2 is 10, and 7 is 17, *&c.* in the next 2 Figures.
8767
10513
5258

639697 Days
by 24 and take in 17 Hours.

2558795
1279395

15352745 Hours
by 60 and take in 35 Minutes

921164735 Minutes
60

Anſ. 55269884100 Seconds, or Moments

PROOF.

In 55269884100 Seconds, how many Minutes, Hours, Days, and Years.

Divide this by 60, 60, 24, and 365, and you will find 1752 Years, 217 Days, 17 Hours, 35 Minutes.

☞ *Note*, According to your Tables in Time, 365 Days 6 Hours make a Year; therefore, as many Years as is given, you muſt multiply them by 6, and add them to the Hours.

Queſt. 20. If a Lad be juſt 12 Years old, how many Hours are ſince expired?

12 Years	12 Years
*365	6 Hours
4380 Days	72 odd Hours in 12 Years
24	
17520	
8760	
105120 Hours	
add 72 odd Hours	
105192	

* *Note*, Though I ſet 365 under 12, yet I multiply 365 by 12, becauſe it is done in one Line.

SECTION II.

Of COMPOUND REDUCTION.

Tyro. WHY do you call this *Compound Reduction?*

Philo. Becauſe it is compounded of *Multiplication* and *Diviſion*, and cannot be done without both.

Tyro. What is its particular Uſe?

Philo. It teaches us to reduce any Sort of foreign Money into Pounds *Sterling*, and the contrary; ſo that it is uſeful in all Buſineſs and Traffick, as appears by the following Table and Examples.

A ſelect ALPHABETICAL TABLE *of Foreign Coins.*

NAMES.	*Value Sterling.*	*What Country.*
Abaſhee	16 Pence	*Perſia*
Aſar	6 *s.* 8 *d.*	*Ditto*
Aſper	3 Farthings	*Turkey*
Beſſe	3 Halfpence	*Perſia*
Capan	3 Pence	*Eaſt India*
Capeck	1 Penny	*Muſcovy*
Cohan	30 Shillings	*Japan*
Chriſtiana	16 Pence	*Sweden*
Copſtake	1 Shilling	*Germany*
Cruſado	6 *d.* 2 *d.*	*Ditto*
Ditto	2 *s.* 10 *d.*	*Portugal*
A Crown	4 *s.* 6 *d.*	*France*
Ditto	5 *s.* 3 *d.*	*Florence*
Ditto	7 *s.* 6 *d.*	*Rome*
Ditto	1 *l.* 2 *s.*	*Barcelona*
A Dina	1 *l.* 10 *s.*	*Aleppo*
A Dollar	4 *s.* 6 *d.*	*Italy*
A Lion Dollar	4 *Shillings*	*Aleppo*
A Croſs Dollar	4 *s.* 2 *d.*	*Holland*
A *Specie* Dollar	5 *Shillings*	*Ditto*
A *Zealand* Dollar	3 *Shillings*	*Ditto*

NAMES.	*Sterling.*	*Country.*
Old Philip's Dollar	5 Shillings	*Holland*
Leopold's Dollar	4 *s.* 3 *d.*	*Ditto*
Rudolphus's Dollar	4 *s.* 4 *d.*	*Ditto*
Prince of *Orange*'s Dollar	4 *s.* 4 *d.*	*Ditto*
Maxamilian's Dollar	4 *s.* 5 *d.*	*Ditto*
Ferdinando's Dollar	4 *s.* 3 *d.*	*Ditto*
Dollar	2 *s.* 3 *d.*	*Dantzick*
Dollar	2 *s.* 3 *d.*	*Sweden*
A Rix-Dollar of the Empire	4 *s.* 3 *d.* ¼	*Germany*
A Ducat	4 *s.* 8 *d.*	*Hungary*
Ditto	4 *s.* 8 *d.*	*Poland*
A *Valentia* Ducat	5 *s.* 3 *d.*	*Spain*
A *Saragoza* Ducat	5 *s.* 6 *d.*	*Ditto*
A *Barcelona* Ducat	6 Shillings	*Ditto*
Ducat	5 Shillings	*Naples*
A Ducatoon	6 *s.* 3 *d.* ⅜	*Holland*
A Piece of Eight in common	4 *s.* 6 *d.*	*Spain*
A *Mexico* Piece of Eight	4 *s.* 6 *d.* and 4 *s.* 4 *d.* ½	*Ditto*
A *Peru* Piece of ditto	4 *s.* 5 *d.*	*Ditto*
A Florin	4 *s.* 4 *d.*	*Ditto*
Ditto	3 *s.* 4 *d.*	*Germany*
Ditto	2 *s.* 6 *d.*	*Sicily*
Ditto	2 Shillings	*Holland*
Greven	1 Shilling	*Muſcovy*
Guilder, or Gilder	3 *s.* 8 *d.*	*Germany*
Ditto Gold	4 *s.* 9 *s.*	*Ditto*
Ditto of *Noremberg*	7 *s.* 1 *d.*	*Ditto*
Ditto	5 Shillings	*Portugal*
Ditto	18 Pence	*Dantzick*
A Harpur	9 Pence	*Iriſh*
A Livre is 20 Sous	18 Pence	*France*
A Mark	13 *s.* 4 *d.* not current	*England*
Ditto	16 Shillings	*Denmark*
Ditto	2 Shillings	*Germany*
Mark-Lups	3 *s.* 9 *d.* ¾	*Poland*
Meſſe	15 Pence	*Eaſt India*

Mill-

NAMES.	*Sterling.*	*Country.*
Mill-Ree (is 1000 Rees) —	6*s*. 9*d*. nearly	*Portugal*
A Moidore, marked 4000, or 4 Times 6*s*. 9*d*. *viz.* —	27 Shillings	*Ditto*
An Obb, or Cobb ½ a Harpur	4*d*. ½ penny	*Iriſh*
A Pattacoon, or Pettavoon	4*s*. 8*d*.	*Spain*
A Ruble — —	10 Shillings	*Muſcovy*
Seraph — —	5 Shillings	*Turky*
Timph — —	7 Pence	*Poland*
Tical — —	2*l*. 16*s*. 3*d*.	*China*
Tari — —	5 Pence	*Sicily*
Toman Gold — —	3*l*. 6*s*. 8*d*.	*Perſia*
Zachin — —	7*s*. 6*d*.	*Venice*
Zelot — —	7*d*. ½ penny	*Turky*

Here follows another uſeful Table.

A TABLE *of the juſt Weight of the cuſtomary Gold Coins uſed in* England.

	dwts.	*Grains.*
A Port	9 –	5
½ Port	4 –	14
A Moidore	6 –	22
½ Moidore	3 –	11
Guinea	5 –	9
½ Guinea	2 –	16
A Piſtole	4 –	8

Note 1. Theſe all weigh ſomething more than is ſet down in the Table; but as it is fractional Parts I have omitted them.

Note 2. If a Guinea don't want above 7 Grains, a Moidore above 9, and a Six and Thirty above 12 Grains of Weight, you may ſafely take them.

Note 3. Scales and Weights for this Purpoſe are made by Mr. *John Kirk* in *St. Paul's Church-Yard, London.*

Tyro. I am obliged to you, Sir.

Philo. And now, *Tyro*, I will give a Variety ſufficient for any careful Learner to do any Queſtion relating to common Courſe of Buſineſs: But before you begin, I would deſire you to mind the two following Obſervations.

Obſervation 1. When one Sum of Money, or any Weight or Meaſure, is to be brought into another Sum of a different Name or Denomination; then always remember, that before you divide, you make the *Diviſor* and *Dividend* of the ſame Name. That is, if the *Dividend* be Pounds, Pence, Yards, Shillings, *&c.* your *Diviſor* muſt alſo be of the ſame Name.

Obſervation 2. Take Notice likewiſe, that your *Remainder* is always of the ſame Name as your *Dividend* and *Diviſor*, be it what it will. Theſe Obſervations kept in Memory will be of great Service to you in the *Rule of Three direct*, and in all common Rules of Arithmetic.

1. QUESTIONS *in* Compound REDUCTION.

In 324 Moidores, how many Pounds?

324 Moidores

1 Moidore 27 Shillings

2268

648

Shillings 2|0)874|8 Shillings

£. 437 - 8 Shillings

2. A Merchant at *London* delivers to his Correſpondent as much Broad-Cloth as comes to £. 547 - 14 - 7; and he is to receive the ſame in *Croſs Dollars*, at 4*s.* 2*d.* each: How many muſt he receive?

Rule. Bring the Money into Pence, and divide by the Pence in 1 Dollar.

s. *d.*
4 - 2
12
—
50

£. 547 - 14 - 7
20
———
10954 Shillings
12
———
Pence in a Dollar 5|0)131455 Pence
———
26291 Croſs Dollars. *Anſ.*

3. How many *Cruſadoes*, at 6 *s.* 2 *d.* each, muſt be paid for 1000 *Guilders* of *Noremberg*, at 7 *s.* 1 *d.* each?

s. *d.*
Cruſado 6 - 2
12
—
74 Pence

1000 Guilders
85
———
74)85000(1148
74
———
110
74
———
360
296
———
640
592
———
48 Pence

s. *d.*
7 - 1 Guilder
12
—
85 Pence

Anſ. 1148 Cruſado's 4 and Shillings

Queſt. 4. How many *Rix Dollars*, at 4*s.* 3*d.* $\frac{1}{4}$ each, may I receive for £. 1750 – 15 – 6 $\frac{1}{2}$ Sterling?

Rule. Bring the Sterling Money into Farthings, and divide by the Farthings in 1 Dollar.

s. *d.*
4 - 3$\frac{1}{4}$
12
51
4
205

£. 1750 – 15 – 6$\frac{1}{2}$
20
35015 Shillings
12
420186 Pence
4

Farthings in 1 Dollar 205)1680746(8198 R. Doll. *Anſ.*
1640 and 156 Farth.
or 3*s* 3*d.*
407
205
2024
1845
1796
1640
by 4)156 Farthings over *
by 12)39 Pence
3 – 3 Pence

Tyro. * The *Remainder* I ſee is *Farthings* as well as the *Dividend*; and I ſuppoſe you divide it by 4, and by 12, to bring it into Pence and Shillings: Do you not?

Philo. You ſay right; and all other Queſtions are done after the ſame Manner.

Queſt. 5. In 276 Cruſado's, at 6*s.* 2*d.* each, how many *Hungarian* Ducats, at 4*s.* 8*d.* each?

```
     s.  d.                 276 Cruſado's
     4 – 8                   74 Pence in a Cruſado
    12                   ———————                       s.  d.
    ——                     1104                        6 – 2
    56                    1932                         12
                         ———————                       ——
Pence in a Ducat   56)20424(364 Ducats Anſ.          74 d.
                      168
                      ————
                       362
                       336
                      ————  Anſ. 364 Ducats, and 40
                        264     Pence over, or 3s. 4d.
                        224
                      ————
                         40 Pence over
```

Queſt. 6. In £. 347 - 15 - 7, how many *French* Crowns, at 4*s*. 6*d*. $\frac{1}{8}$ each?

£.347 - 15 - 7
20

6955 Shillings
12

d.
A Crown 54 $\frac{1}{8}$
8

83467 Pence
8 Eighths in 1 Penny

433 Eighths

433)667336(1541 *Anſ*. 1541 *French* Crowns, and 10 *d*. $\frac{3}{8}$
433

2343
2165

1783
1732

516
433

8)83

10 $\frac{3}{8}$

Here I multiply the Pence by 8, and the *Dividend* and the *Diviſor* an Eighth of a Penny, the Remainder alſo is 8ths of a Penny; therefore, I divide it by 8, and it is 10 Pence, and 3 Eighths over.

Note 1. As you do not underſtand *Fractions* as yet, it may not be amiſs to give you a Word or two by Way of Information. You ſee a *French* Crown in the above Example is valued at 54*d*. 1 Eighth, that is, 54 Pence, and 1 Eighth of a Penny, which 1 Eighth is called a Fraction; the 1 which ſtands a-top, is called the Numerator, and the 8 is the Denominator: So alſo $\frac{3}{7}$ is read 3 Sevenths, $\frac{5}{11}$ is 5 Elevenths, and $\frac{3}{5}$ is 3 Fifths. Here 2, 5, and 3 are Numerators, and 7, 11, and 5 are the Denominators.

Note 2. The Rule to work by Fractions in all ſuch Caſes as this, is thus. Multiply the whole Number by the *Denominator*, that is, the lower Figure of the Fraction, and take in the Top-Figure, or *Numerator*.

Queſt. 7. A Merchant ſends to his Correſpondent as much Corn as comes to £. 1575, to receive the ſame in *Ducatoons*, at 6*s*. 3*d*. $\frac{3}{5}$ each; how many ought he to receive?

s. *d*.
6 - 3$\frac{3}{5}$
12

75
by 5 and take in the Top 3

378 Fifths

£. 1575
20

31500 Shillings
12

378000 Pence
by 5 brings *d*. into 5ths

Diviſor 378)1890000(5000 Ducatoons. *Anſ.*
1890

000

Queſt. 8. In £. 1000 how many 7 Pence Halfpennys?

£. 1000
20

20000 Shillings
12

240000 Pence
4

Farthings in 7 $\frac{1}{2}$ are 3|0)96000|0

32000 *Anſ.*

Or thus:
960 Farth.
1000

3|0)96000(0.

32000 *Anſ.*

Queſt. 9. In 100 *Portugal* Pieces, at 36 Shillings each, how many Pounds, Half Crowns, and Crowns?

Piece 36 Shillings
100

2|0)360|0 Shillings

180 Pounds
8 Half Crowns 1 Pound

2)1440 Half Crowns

720 Crowns

Here you ſee I multiply, or divide always by as many of the *leſs* as make one of the *greater*, according as the Nature of the Queſtion requires.

Queſt. 10. In 432 Moidores, how many Shillings, Crowns, Groats, and Farthings?

	432	Moidores
	27	Shillings 1 Moidore
	3024	
	864	
Shillings in 1 Crown	5)11664	Shillings
Crowns	2332	4*s.* over, or 12 Groats
Groats in 1 Crown	15	and take in 12 Groats
	11662	
	2333	
	34992	Groats
Farthings in 1 Groat	16	
	209952	
	34992	
	559872	Farthings

Tyro. I ſee now, Sir, the Nature of the Rule plainly; but pray how do you manage when there is a Sum of Money to be paid in Pieces of different Value, and that there ſhall be as many in Number of one Sort as of another; that is, an equal Number of every Sort?

Philo. This is very uſeful in many Reſpects, and is done by this general Rule, *viz.* Add all the Pieces together; then bring the Sum of Money to be paid, and the Sum of all the Pieces, into one Name or Denomination; and *laſtly*, divide the Sum to be paid by the Total of all the Pieces, and the Quotient is the Number of each, one with another.

Queſt. 11. How many Shillings, 6 Pences, 4 Pences, 3 Pences, 2 Pences, Pence, Half-pence, and Farthings, of each a like Number, will diſcharge a Debt of £.335 – 8 – 4? *Anſ.* 2800 of each.

I ſet down all the Pieces one under another, as follows:

A Shilling is 12
6
4
3 £.335 – 8 – 4
2 20
1
½ 6708 Shillings
¼ 12
Pence 28¾ 80500 Pence
4 4
Farthings 115| 115)322000(2800 Pieces of each Sort
230
920
920
00

Here I bring £.335 – 8 – 4 into Farthings, and divide by 115, the Farthings in all the Pieces, and the Anſwer is 2800 of each.

OBSERVATION I.

1. When any Pieces of Money are to be brought into Pounds *Sterling*, you ſhould conſider what Relation thoſe Pieces bear to a Pound *Sterling*; that is, what Part of a Pound it conſiſts of; for, by this the Work will be rendered much ſhorter, and you will not have Occaſion to

reduce the Work into Pence: But of this I ſhall ſhew you more fully in the *Rule of Three Direct*.

Queſt. 12. In £. 270 how many Nobles, at 6*s*. 8*d*. each?

```
270
  3 Nobles, or 3 Times 6 s. 8 d. is 1 Pound
———
810 Anſ.
```

To bring Nobles into Pounds, divide by 3.

Queſt. 13. In £. 270 how many Marks, at 13*s*. 4*d*. each?

Here, as 13*s*. 4*d*. is 2 Thirds of a Pound, I multiply the Pounds by 3, and divide by 2, as follows.

```
  270
    3
 ————
2)810
 ————
  405 Marks. Anſ.
```

Tyro. This is much ſhorter than to bring the *Pounds* and the *Marks* into Pence, and have to divide beſides.

Philo. To be ſure it is, and when you want to bring *Marks* into *Pounds*, then multiply by 2, and divide by 3; for you muſt have leſs *Pounds* than *Marks*, becauſe a *Pound* is larger than a *Mark*. And thus, *Tyro*, by your Care and Obſervation, you may work many Sums ſhorter than the common Form of Rules in general laid down; for it is impoſſible (without a large Volume indeed, and even not then) to lay down Rules and Examples to make a careleſs Learner underſtand: But a diligent Learner, that is deſirous to know, and make himſelf perfect, will not only obſerve the Rules given him, but will alſo try and contrive Methods of his own, and is not ſatisfied with knowing Things by Halves.

Queſt. 14. Suppoſe a Bill of Exchange was accepted at *London*, for £.580, for Value received at *Amſterdam*, how many *Flemiſh* Pounds ought to be remitted at *Amſterdam?*

33 – 4 One *F.* Pound
12
Diviſor 400 Pence

£.580
20
11600
12
4|00)1392|00
Anſ. 348 *Flem.* Pounds.

Do you underſtand it..

Tyro. I do; for let the Queſtion be what it will, I have nothing to do but to make them both of a Name, and multiply, or divide by as many of the Leſs, as make one of the Greater; then the Quotient (if a Diviſion Sum) will be the Anſwer, and the Remainder the ſame as the Dividend.

Philo. Very well; then I will ſet you one Sum more for Trial.

Queſt. 15. A General of an Army (conſiſting of 5000 Men) after a very ſharp Engagement loſt 2380 Men; but coming off victorious, he, for their valiant Behaviour, gave 1000 Guineas to be equally divided among them, and the Remainder (if any) to be given to a little Errand-Boy: How much did each Man receive?

Tyro. I proced thus: I take 2380 Men that were loſt, out of 5000, and there remains 2620 that eſcaped. Then I reduce 1000 Guineas into Farthings, and fin it 1008000, and dividing this by the Number of Men, that eſcaped, *viz.* 2620, I find the Quotient 384 Farthings, that is, juſt 8 Shillings each Man, and 192 Farthings remaining over, which is 4 Shillings for the little Errand-Boy, as appears by the following Work.

The Work.

5000 Soldiers
2380 killed

Diviſor 2620 eſcaped

1000 Guineas
21

21000 Shillings
12

252000 Pence
4

Men
262|0)100800|0(384 Farthings each
786

2220
2096

1240
1048

4)192 Farthings remains

12)48 Pence

4 Shillings for the little Boy

4)384 Farthings

12) 96 Pence

8 Shilling, each. *Anſ.*

Phil. Very well done indeed.

LONG.

LONG-MEASURE.

Queſt. 16. How many Furlongs, Rods, Yards, Feet, Inches, and Barley-Corns will reach round the World, ſuppoſing it (according to the beſt Calculation) to be 25020 Miles.

25020 Miles *
8

200160 Furlongs
40

8006400 Rods
11 Half Yards in 1 Rod * *

by 2)88070400 Half Yards

44035200 Yards
3

132105600 Feet
12

1585267200 Inches
3

4755801600 Barley-Corns

* According to this Calculation of 25020 Miles round the Globe, 69 $\frac{1}{2}$ Miles make 1 Degree. See the *Note* in *Page* 49, *Long-Meaſure*.

* * *Note*, That 5$\frac{1}{2}$ Yards make 1 Rod; but becauſe I cannot well multiply by 5$\frac{1}{2}$, I therefore multiply by 11, and they are $\frac{1}{2}$ Yards; and then divide by 2 to bring them into Yards.

Another

Another Way.

As 1760 Yards make a Mile, if you multiply 25020 by 1760, you will have the ſame Anſwer in Yards; and if you multiply the Yards by 36, you will have the Inches, *&c.*

SECTION III.

QUESTIONS *to exerciſe* REDUCTION.

1. IN £. 56 how many *Crowns* and *Six-pences?* *Anſ.* 224 Crowns, and 2240 Six-pences.

2. In 8568 Pence, how many Shillings, and Guineas? *Anſ.* 714 Shillings, and 34 Guineas.

3. In £. 12 − 2 Shillings, how many Groats, 3 Pences, and 6 Pences? *Anſ.* 726 Groats, 968 Three-pences, and 484 Six-pences.

4. In 750 Moidores, how many Pounds and Guineas? *Anſ.* 555 Moidores, and 714 Guineas, and 6 Shillings over.

5. In 50 *Ports*, at 36 Shillings each, how many Pounds, Half Crowns, Crowns, and Groats? *Anſ.* £. 900, 7200 Half Crowns, 3600 Crowns, and 54,000 Groats.

6. In £. 500 how many Pieces, at 7*d.* $\frac{1}{2}$, and Pieces at 7*s.* 6*d.* each? *Anſ.* 16,000 Pieces, at 7*d.* $\frac{1}{2}$. And 1333 Pieces, at 7*s.* 6*d.* each, and $\frac{1}{3}$ of a Piece, or 2*s.* 6*d.*

7. A Merchant at *Holland* draws a Bill upon his Correſpondent in *London*, for 2500 Ducatoons, at 6*s.* 2*d.* $\frac{3}{4}$ each, how many Pounds *Sterling* ought he to receive at *London*. *Anſ.* £. 777 − 1 − 8.

Rule. Bring a *Ducatoon* into 5ths of a Penny, (as in *Page* 137) and multiply the Number of *Ducatoons* by them; then bring a Pound *Sterling* alſo into *Fifths* (*viz.*

1200 Fifths) and dividing by 1200, you will have the £. 777 $\frac{1}{12}$; that is, £. 777 one Twelfth of a Pound, or 1*s.* 8*d.*

8. A rich *Nobleman* has 5 Villages, in every Village 3 Streets, in every Street a Dozen Houſes, in every Houſe 5 Rooms, in every Room 2 Bureaus, in every Bureau 12 Drawers, in every Drawer 4 Bags, every Bag valued at 150 Guineas; which he is going to *exchange* for £. 3 – 12 Shillings Pieces, how many muſt he receive in all?

Rule. Multiply all the Numbers by one another as they follow in Order, and your laſt Product will be Guineas. Bring theſe Guineas into Shillings, and divide by 72, the Shillings in a £.3 – 12 Piece, you'll have the Anſwer, which is 3780000 Pieces, at £.3 – 12 Shillings each.

And thus, *Tyro,* may you by Diligence and Obſervation do any Sort of Sum.

Tyro. Sir, I ſee it plainly, and will try to do them all, and prove their Anſwers, the firſt Opportunity.

Philo. Then I will now proceed to the moſt beautiful and moſt uſeful Rule in all common *Arithmetic, viz.* the *Rule of Three Direct,* commonly called the *Golden Rule of Three.*

DIALOGUE VII.

SECTION I.

The Single Rule of Three Direct, *commonly called the* GOLDEN RULE.

Tyro. WHAT do you mean by the *Rule of Three direct?*

Philo. The *Rule of Three* is the *Rule of Proportion*; becauſe it ſhews what *Relation* or *Proportion* one Number bears to another.

Tyro. What is given, and what is required in the *Rule of Three?*

Philo. *Three* Numbers are given to find a *Fourth*, which is the Anſwer.

Tyro How is this *fourth* Number found?

Philo. By this one *General Rule.* Multiply the ſecond Number by the Third, and divide by the Firſt.

Tyro. How does the Proportion of theſe 4 Numbers ſtand, or what Relation do they bear to each other.

Philo. As the *firſt* is to the *ſecond* Number, ſo is the *third* to the *fourth* Number. For if you multiply the *fourth* Number, or *Anſwer*, by the *firſt*, the Product will be the ſame as the *Third*, multiplied by the *Second*: But more of this by and by.

Tyro. How am I to work the *Rule of Three direct?*

Philo. By the following Rule, which you ought ſo far to get by Heart, as to underſtand it without Book.

A General RULE.

1. When any 3 Numbers are given, place them one after the other, in Order, as they ſtand, and this is called ſtating the Queſtion.

This being done, multiply the *Second* by the *Third*, and divide by the *Firſt*, and you have the *fourth* Number, or Anſwer.

Let the three Numbers be 4, 8, and 12.

*4 : 8 :: 12 to a 4th Number, *viz.* 96.

```
        8
        —
      4)96
        —
       24 Anſ.
```

* *Note*, That 2 Dots, one over another, thus (:) ſignifies the Word *to*; and 4 Dots thus (::) ſignify, or is read, *ſo is*: Thus 4 : 8 :: 12 : 96 is thus read: As 4 *to* 8, *ſo is* 12 *to* 96, and ſo for any other Number in Proportion.

Here you ſee the *fourth* Number, or Anſwer, is 24.

Now, *Tyro*, it is worth your while to obſerve what *Relation* or *Proportion* theſe bear to each other.

OBSERVATION I.

As the *Firſt* is to the *Second*, ſo is the *Third* to the *Fourth*. That is, as 4 is to 8, ſo is 12 to 24: For 4 is the Half of 8, and 12 is the Half of 24.

OBSERVATION 2.

As the *Firſt* is to the *Third*, ſo is the *Second* to the *Fourth*. That is, as 4 to 12, ſo is 8 to 24: For 12, the *third* Number, is 3 Times more than 4, the *firſt* Number; and 24, the *fourth* Number, is 3 Times more than 8, the *ſecond* Number. Or, in other Words, thus: The *Third* divided by the *Firſt*, is equal to the *Fourth* divided by the *Second*, And thus you will find the *Proportion* holds good, take the Numbers which Way you will, as by the following *Obſervations*.

OBSERVATION 3.

The *firſt* Number is equal to the Product of the *ſecond* and *third*, divided by the *Fourth*; that is, 96 divided by 24 is equal to 4,

OBSERVATION 4.

The *Second* is equal to the Product of the *Firſt* and *Fourth*, divided by the *Third*; that is, 96 divided by 12, is equal to 8.

OBSERVATION 5.

The *Third* is equal to the Product of the *Firſt* and *Fourth*, divided by the *Second*; that is, 96 divided by 8 is equal to 12.

OBSERVATION 6.

The *Fourth* is equal to the Product of the *Second* and *Third*, divided by the *Firſt*; that is, 96 divided by 4 is equal to 24*.

Tyro. This is very pretty indeed! And will this *Proportion* hold ſo in any other 3 Numbers.

Philo. No Doubt of that; if you will try any 3, you will find they will anſwer to the foregoing *Obſervations*.

This is only to ſhew you, *Tyro*, the Nature of Proportion, relating to Numbers, without any particular Name; but as for working the *Rule of Three direct*, when the Numbers are called by the Names of *Pounds*, *Yards*, *Ells*, *Ounces*, *Pence*, or the like; that indeed is the Effect of Practice, and may very ſoon be learned by the following Inſtructions, or Directions.

---

* See more of this in my *Young Algebraiſt*'s *Companion*, Dialogue 7, Section 2.

SECTION II.

Containing ſome full and neceſſary Directions for the better performing this Rule.

Tyro. YOU have already told me, that there are always *three Numbers* given to find a *Fourth*; but in what Order am I to place them, when they are of a different Name, or Denomination. That is, *How am I to ſtate the Queſtion?*

Philo. Do you but mind the following Inſtructions, and read your Queſtions over ſlow, and conſiderately, and you will ſoon know how to *ſtate* it, or place the Numbers in their Order; for I ſhall firſt of all give you Directions to work common eaſy Sums, and then ſhew you how to proceed when the *firſt* and *third* Numbers are not alike, and when there is required two or three Statings.

SECTION III.

DIRECTIONS *to ſtate and work eaſy Queſtions in the* Rule of Three Direct.

Firſt, ALWAYS remember that when 3 Numbers are given, *two* of theſe Numbers always are of one and the ſame Name and Denomination, *viz*, either Money, Weight, or Meaſure, which *two Numbers* out of the *three*, muſt be your *firſt* and your *third* Number; and the other in Courſe muſt be placed in the Middle, which *middle Number* will always be of the ſame Name as the Anſwer. Thus, if the *ſecond* or *middle Number* be *Money*, *Weight*, or *Meaſure*; ſo alſo will the *fourth Number* or *Anſwer* be.

2. If at any Time the *firſt Number*, or the *third*, be of a higher or greater Denomination than the other, then make them both of one Denomination by the Rules of *Reduction*. Thus, if the *firſt Number* be Yards, and the *third Number* Ells, reduce them both into Quarters, by multiplying the Yards by 4, and the Ells by 5; ſo alſo if the *firſt Number* be *lbs.* and the *third Cwts.* and *qrs.* you muſt reduce the *Cwts.* and *qrs.* into the *lbs.* that they may not only be of one Name, (Weight, Meaſure, *&c.*) but likewiſe the very ſame Name, *viz. Pounds, Pence, Yards, Quarters*, &c.

3. If your *ſecond Number* be a compound Quantity, ſuch as *Pounds*, *Shillings*, and *Pence*, or *Cwts. qrs.* and *lbs.* you muſt reduce it into Pence, or into *lbs.* by the Rule of *Reduction*; and remember, that after you have multiplied the *ſecond* by the *third*, and divided by your *firſt*, the Quotient will be of the ſame Name as you reduced your *ſecond* Number into, be it what it will.

4. In all Queſtions in the *Rule of Three*, where there is only 3 Numbers given, you have already been told, that *two* of thoſe *three* will always be of one Name, and muſt be your *firſt* and *third* Numbers. Now, it is very eaſy to know which of thoſe *two* muſt be your *third* Number: For whenever a Queſtion is aſked, or whatſoever Number follows the Queſtion, *that* is your third Number. Thus, what coſt 24 Yards? Or how much does 96 *lb.* coſt? Here 24, or 96, will be your *third* Number; and ſo for any other Queſtion, as you will ſee by the two firſt Examples, as follows.

Queſt. 1. If 3 Yards coſt 7 Shillings, what coſt 24 Yards?

Yards Shill. Yards
If 3 —— 7 —— 24
7 multiply

Divide by 3)168

by 2|0) 5|6 Shillings

2*l.* 16*s.* *Anſ.*

Proof, or Proportion.

As 3 : 7 :: 24 : 56. For 3 Times 56 is 168, and 7 Times 24 is 168. And thus for any other Queſtion.

Queſt. 2. If 8 Ells coſt 11 Shillings, what coſt 96 Ells?

Ells Shill. Ells
If 8 —— 11 —— 96
11

8)1056

2|0) 13|2

£.6 – 12 *Anſ.*

☞ *Note,* Here you ſee that the Queſtion is aſked, what coſt 24 Yards, or what coſt 96 Ells; therefore, you may be ſure theſe are to be your third Number. Then your *firſt* is plainly known by being of the ſame Name; and your *middle*, or *ſecond* Number, muſt be known of Courſe, which will always be the ſame Name as the Anſwer. See *Obſervation* 1.

Rule. Having ſtated the Queſtion, I multiply the *ſecond* by my *third* Number, or the *third* by the *ſecond*, and divide by the *firſt*, and the Anſwer is 56 Shillings, which is the ſame Name as the *ſecond* Number; then I divide thoſe Shillings by 20, and have the Anſwer. The ſecond Queſtion is done the ſame.

Tyro. I ſee the Nature of it plainly; but there is a Way to prove Sums in the *Rule of Three*, by ſtating them backward, is there not?

Philo. Yes; and a very good Method it is to confirm you in the Truth of what you have done; for the Queſtion will then be turned quite the reverſe Way.

Firſt Proof, or Variation.

If 24 Yards coſt 56 Shillings, what coſt 3 Yards?

```
    Yards  Shill  Yards
    If 24 —— 56 —— 3
              3
           ———
        24)168(7 Shillings.  Anſ.
          .168
           ———
             0
```

Here you ſee the *fourth* Number in the original Queſtion, is the *firſt* Number in this Queſtion; the Anſwer of the Original is the *ſecond* Number; and the *ſecond* Number in the Original is the *Anſwer* here.

Second Proof, or Variation.

If 7 Shillings buy 3 Yards, how many can I have for 56 Shillings?

Here I find 2 Numbers out of the 3 are Money, and the Number following the Queſtion *(how many)* is 56 Shillings; therefore, 56 Shillings is my third Number; which is thus ſtated.

Shill. Yards Shill.
If 7——3——56
3
———
7)168
———
24 Yards. *Anſ.*

So that you ſee, by minding which *Two* of the *Three* are of the ſame Name, it is no difficult Matter to ſtate any common Queſtion, and others more difficult will naturally follow by Uſe and Practice.

Tyro. I underſtand it very well indeed, and heartily thank you.

Philo. Then I ſhall proceed to give you more uſeful Examples, and when any Thing occurs that you don't rightly apprehend, aſk me, or read the Inſtructions over again.

Queſt. 3. If 3 *lb.* of Tobacco, (or any other Thing) coſt 2*s.* 9*d.* what coſt 255 *lb.*

```
    lb.    s.     d.         lb.
If  3 ——— 2 ——— 9 ———— 255
          12                  33  Second Number
          ——                 ————
          33                 765
                            765
                            ————
                           3)8415
                            ————
                          12)2805  Pence
                            ————
                          2|0)23|3-9
                            ————
                          £. 11 - 13 - 9  Anſ.
```

PROOF.

```
      Pence      lb.     Pence
If  2805 ——— 255 ——— 33
                 33
                ————
                765
               765
               ————
        2805)8415(3 lb.  Anſ.
             8415
             ————
               0
```

☞ The *ſecond Number* being *Shillings* and *Pence*, I bring them into Pence by multiplying by 12, and taking in the odd 9 Pence; and after I have multiplied the *third Number* 255 by 33, and divided by my *firſt*, which is 3, the Quotient is of the ſame Name ſtill, *viz.* Pence, which I divide by 12, to bring into Shillings, and by 20 to bring them into Pounds, as above: And thus for any common Sum. See *Obſervation* 2.

Queſt. 4. If an Ounce of Tobacco coſt 5 Farthings, what coſt 2 C. 3 *qrs.* 21?

```
    oz.  Farth. C.    qrs    lb.
If *1 —— 5 —— 2 —— 3 —— 21
               4
            ————
              11 qrs.
              28
            ————
              89
             24
            ————
             329 lb.
              16
            ————
            1974
            329
            ————
            5264 oz.
               5 Second Number
            ————
        4)26320 Farthings
            ————
       12) 6580 Pence
            ————
     2|0) 54|8–4d.
            ————
       £.27 – 8 – 4 Anſ.
```

* *Note*, Becauſe the *firſt* Number is Ounces, I bring the *third* Number alſo into Ounces, to anſwer it; but after I have multiplied by my *ſecond* Number 5, they are all Farthings; and as my *firſt* Number is only an Unit (or 1) I do not divide by *that*; for 1 neither multiplies nor divides: I therefore only divide the Farthings by 4, 12, and 20, and the Queſtion is done. See the *Proof* the next Queſtion.

Queſt. 5. If 2 C. 3 *qrs.* 21 *lb.* (or 5264 Ounces) coſt £. 27 – 8 – 4, what coſt an Ounce?

oz. £. *s.* *d.* *oz.*
If 5264 —— 27 – 8 – 4 —— 1
20
548
12
6580
4
5264)26320(5 Farth. *Anſ.*
26320
0

☞ Take Notice that whenever your *firſt* Number is large, and the *third* ſmall (as in this Example) that you always reduce the *middle*, or *ſecond* Number, to its loweſt Denomination.

Queſt. 6. Bought a Silver Cup and Tankard, which weighed 3 *lb.* 11 *oz. Troy*, and coſt me £. 8 – 18 – 2½; what did they lie me in *per* Ounce?

Here, as the Queſtion is, *What did they coſt* per *Ounce?* You muſt know your Anſwer is to be in Money; ſo alſo muſt your *ſecond* Number be, and the other two Numbers will naturally follow, thus:

```
   lb.     oz.                £.    s.    d.          oz.
If  3 ——— 11 ————————————   8  -  18  -  2½ ————————— 1
   12 oz. 1 lb. Troy        20
   ——                      ————
   47 oz.                   178 Shillings
                             12
                           ————
                           2138 Pence
                              4
                           ————
                     74)8554(182 Farthings.  Anſ.
                        47
                        ———          4)182 Farthings
                        385           ————
                        376          12)45-2
                        ———           ————
                         94               3s. 9d. ½ per oz. Anſ.
                         94
                        ———
                          0
```

Queſt. 7. A Gentleman has an Eſtate which brings him in clear £ 2000 a Year, and the Charges he is at, one Day with another, for Houſe-keeping, and other Expences, is £. 5 - 15 *s.* I demand what he loſes or ſaves every Year?

Rule. See what £. 5 - 15 *per* Day amounts to in a Year, and take it out of his yearly Income £ 2000 is what he ſaves; but if his Expences be more, take the £2000 from that, and the Remainder is what he loſes.

Day £. *s.* *Days*
If 1 —— 5 - 15 —— 365
20 115
115 1825
4015
2|0)4197|5 Shillings

Yearly Expences £.2048 - 15

Yearly Expences —— £. 2048 - 15
Eſtate —— —— 2000 -
He loſes Yearly —— £. 48 - 15 *Anſ.*

Queſt. 8. A Farmer agreed with his Servant to threſh all the Corn he had, and the Servant was to receive a Guinea for every 7 Quarters: Now, he threſhed in all 15 Loads, 1 Quarter, and has received of his Maſter, at different Times, by Caſh and Goods, 9 Guineas; I demand how the Reckoning ſtands between them.

Rule. Firſt, ſee what 15 Loads 1 Quarter comes to, at a Guinea, or 21 Shillings, *per* Quarter, and then ſubtract 9 Guineas out of it.

qrs. — *s.* — *Loads* — *qr.*
If 7 —— 21 —— 15 —— 1
5 *qrs.* 1 Load
76 *qrs.*
21
76
152
7)1596
2|0) 22|8 Shillings
£. 11 – 8 *Anſ.*

Servant's Wages for threſhing — £. 11 – 8
He received 9 Guineas, *viz.* —— 9 – 9
Due to the Servant —— —— £. 1 – 19 *Anſ.*

Queſt. 9. A Corn-Factor ſends to his Correſpondent in *Spain*, 10,000 Quarters of Wheat, and agreed at £8 – 7 – 6 *per* Load, and he has received by ſeveral Remittances £10,000; what is ſtill due to him?

Loads £. *s.* *d.* *qrs.*
If 1 —— 8 – 7 – 6 —— 10,000

5 20

5 *qrs.* 167

12

2010 Pence

10000

Firſt Number 5)20100000

12)4020000 Pence

2|0)33500|0 Shillings

£.16750 *Anſ.*

Wheat	£16,750
Received	10,000
Due to him	£6,750

Queſt. 10. Bought 4 Bags of Hops, which weighed as under.

No	C.	qrs.	lb.
1	2	3	11
2	1	2	27
3	2	1	17
4	1	3	15
	8	3	14

And gave after the Rate of 5 Guineas *per Cwt.* what do they come to?

C.		£. s.	C. qr. lb.
If 1		5 - 5	8 - 3 - 14 * *
112		20	4
112 *lbs.* 1 *Cwt.*		105	35 *qrs.*

28

284

71

994 *lbs.*

105

4970

9940

Firſt Number 112)104370(931 Shillings divided by 20, is £.46 - 11. So that the Anſwer is £.46 - 11 - 10½

1008

357

336

210

112

98 Remainder

12

112)1176(10 Pence

112

56 Remainder

4

112)224(2 Farthings

224

0

* * *Note,*

* * *Note,* I reduce the *firſt* and *third* into *lbs.* and the *ſecond* into Shillings, and the *Quotient* is Shillings; and the Remainder 98 I multiply by 12, and divide by the ſame *Diviſor* (*viz.* 112) and it gives 10 Pence in the *Quotient*; and the next Remainder I multiply by 4, and it gives 2 Farthings.

* * ☞ See a ſhorter Way than either this, or *Page* 120, to bring *Cts. qrs.* and *lbs.* into *lbs* in *Example* 1, in *Tare* and *Tret.*

Queſt. 10 There is a Ship worth £. 2000 of which I have the $\frac{7}{32}$ Parts: I demand what my Share is worth?

Firſt, according to the common Order of the *Rule of Three*, I ſay,

```
Parts                          Parts
If 32 be—— £. 2000 what is 7
                  7
             ------
        32)14000(437 Pounds
             128
             ----
             120
              96
             ----
             240                  Anſ. £437 - 10s.
             224
             ----
              16 Remainder
              20 Shillings in a £.
             ----
           32)320(10 Shillings
              32
             ----
               0
```

Note, I multiply the Remainder 16 by 20, and divide by the ſame *Diviſor* 32, and the Quotient is Shillings. Had any Thing remained I ſhould now have multiplied it by 12, and divided by 32, and the Quotient would have been Pence, *&c.*

Note, It often happens, that dividing by the Parts is both ſhorter and eaſier than dividing by the whole: Nothing but Practice and Obſervation can make a Man Maſter of this; for ten thouſand Rules without theſe are of very little Account.

OBSERVATION.

Here, according to the Nature of Queſtions of *Multiplication*, or *Diviſion* of Money, I perform the above Queſtion, with Eaſe.

Parts *Parts*
If 32 ——— £. 2000 —— 7
7
8 Times 4 is 32, *by* 8)14000
4)1750
Anſ. £.437 – 10

Here I divide by 8, and by 4; when I divide by 4, I find 2 remain, which I call 2 Pounds; then I ſay the 4th Part of £. 2 is 10 Shillings. And now you may ſee the Beauty of *Multiplication* and *Diviſion of Money*, if you do but obſerve it well.

Tyro. I humbly thank you, Sir, and ſee there is Nothing like knowing the former Rules perfectly.

Philo. As I ſaid before, many Queſtions may be performed by *Multiplication*, and *Diviſion of Money*, if they be rightly applied, and much ſhorter and eaſier than the common Order of the *Rule of Three*. I ſhall give you one Inſtance, and no more, which, if well obſerved, will be ſufficient; for according to the Nature of the Queſtion, a great many Figures may be ſaved as well as Trouble.

Queſt. 11. Bought a Box of ſuperfine Tea, which weighed 2 *qrs*. 7 *lb*. and gave £. 73 - 12 - 7½ for it; what is 5 *lb*. of it worth?

Firſt, and common Way.

```
 qrs.  lb.          £.     s.   d.          lb.
If 2———7——————————73 - 12 - 7½ ——————5
  28                20
  ——              ————
  63              1472 Shillings
                    12
                  ————
                 17671 Pence
                     4
                 —————
                 70686 qrs.
                     5 Third Number
                 —————
           63)353430(5610 Farthings
              315
             ————               Farthings]
              384               4)5610
              378               ——————
             ————              12)1402-½
               63               ——————
               63              2|0)11|6-10
             ————               ——————
                0              Anſ. 5-16-10½
```

Short Way by Multiplication *and* Diviſion of Money.

	lb.	*£.*	*s.*	*d.*	*lb.*	
If	63——	73 -	12 -	$7\frac{1}{2}$ ——	5	
				5		
63 is 9 Times		7)368 -	3 -	$1\frac{1}{2}$		
		9)52 -	11 -	$10\frac{1}{2}$		
		5 -	16 -	$10\frac{1}{2}$		*Anſ.*

Here you ſee that the ſecond Way has but about Half the Figures.

Tyro. I ſee it very plainly; and I think I am able to do any common Sum of but one *Stating.*

Philo. Then we will proceed to *Section* 3.

SECTION IV.

Contains ſome neceſſary Directions in more difficult Queſtions, and ſuch as require more than one Stating.

Tyro. HOW am I to manage when the *firſt* and *third* Numbers are not of one Name, or Denomination.

Philo. Bring them into one Denomination (according to *Direction* 2, *Section* 1.) and proceed by multiplying your *ſecond* by the *third*, and divide by your *firſt*, as before.

Queſt. 12. If 3 Yards coſt 8 *s.* 3 *d.* what coſt 96 Ells *Engliſh.*

Yards *s.* *d.* *Ells Engliſh*
If 3 —— 8 - 3 —— 96
4 12 5
12 *qrs.* 99 480 *qrs.*
99

4320
4320

Firſt Number 12)47520

12) 3960 Pence

2|0) 33|0

£. 16 - 10 *Anſ.*

Rule. Here, becauſe the *firſt* Number is Yards, and the *ſecond* Ells *Engliſh*, I bring them both into Quarters, by multiplying the Yards by 4, and the Ells by 5, and then proceed as before.

Firſt Proof, or Variation.

Queſt. 13. If 96 Ells *Engliſh* coſt £16 – 10*s.* what coſt 3 Yards?

Ells	*£.*	*s.*	*Yards*
If 96	16 –	10	3
5	20		4
480 *qrs.*	330 Shillings		12 *qrs.*
	12		
	3960 Pence		
	12 Third Number		

Firſt Number 480)47520(99 Pence. *Anſ.* or 8*s.* 3*d.*
4320

4320
4320

0

☞ Here you ſee the *fourth* Number, or Anſwer, is the ſame as the *ſecond* Number, in the laſt Queſtion. See the next Queſtion.

Second Variation, or Proof.

Queſt. 14. If I buy 3 Yards of Holland for 8*s.* 3*d.* how many Ells *Engliſh* may I have for £. 16 – 10.

☞ Here, becauſe the Anſwer is to be in Meaſure, therefore Meaſure muſt be my ſecond Number, thus:

```
   s.  d.  Yards.         £.   s.
If 8 – 3 —— 3 ———————————16 – 10
  12                      20
  ——                    ——————
  99 Pence               330 Shillings
                          12
                        ——————
                        3960 Pence
                           3 Second Number
                        ——————
     First Number 99)11880(120 Yards
                     99
                    ——————
                     198
                     198           Yards.
                    ——————          120
                       0              4 qrs 1 Yard
                                    ——————
                  Qrs 1 Ell 5)480 qrs
                              ——————
                               96 Ells.  Anſ.
```

☞ Here you ſee I do not bring the ſecond Number, Yards, into Quarters, as I did before in the other two Queſtions; for it is better to work with it as it is; becauſe it ſaves a great many Figures, and the Anſwer will be 120 Yards, which I reduce into Ells very eaſily, by multiplying by 4, and dividing by 5; and if you conſider all the three different Ways of working this Queſtion, it will be of great Service to you.

Queſt. 15. A Draper bought 12 Pieces of Holland, each Piece containing 23 Ells *Engliſh*, and gave after the Rate of 3*s.* 4*d.* *per* Ell *Flemiſh*; what did they come to?

Firſt 23 Ells 1 Piece
12 Pieces
276 Ells in all

Ell Fl. *s.* *d.* *Ells Eng.*
If 1 ——————— 3 - 4 ——————— 276
3 qrs 1 Ell *Fl.* 12 5
3 qrs 40 Pence 1380 qrs.
40
3)55200
12)18400 Pence
2|0) 153|3 - 4
£.76 - 13 - 4 *Anſ.*

Tyro. I am obliged to you; and now, if you pleaſe, I will try at one.

Philo. With all my Heart; I like to ſee you in this Mind.

Queſt. 16. A Woollen-Draper bought 4 Packs of Cloth, each Pack containing 3 Parcels, each Parcel 6 Pieces, and each Piece 40 Yards, and gave 3*l.* 10*s.* for every 6 Yards one with another; what do they come to?

Tyro. Firſt, I ſee how many Yards there are in all, by multiplying them together as they ſtand, thus:

4 Packs	*Yards* £. *s.*	*Yards*
3	If 6—3 - 10——	2880
	20	70
12 Parcels		
6	70	6)201600 Shillings
72 Pieces		2|0) 3360|0
40		
		1680 *Anſ.*
2880 Yards in all		

Philo. Very right; and you may prove this Sum ſeveral Ways at Leiſure, which will be of Service. Firſt, £3 - 10*s.* every 6 Yards, is 11*s.* 8*d.* for 1 Yard. Therefore ſay, if 1 Yard coſt 11*s.* 8*d.* what coſt 2880, and it will be the ſame Anſwer. And again, you know 2880 Yards, at £1 *per* Yard, is £2880; therefore ſay, If 20 Shillings be 11*s.* 8*d.* what will £2880 be; and you will have 1680 for Anſwer, as before.

Queſt. 17. How many Dozen of Candles, at 5 *s.* 3 *d.* *per* Dozen, may I have in *Exchange* for 3 Pieces of *Iriſh*, each long 20 Ells, at 3*s.* 9*d.* *per* Yard?

Here is two Statings in this Queſtion; Firſt, ſee what the *Iriſh* comes to, and as the Queſtion aſks, how many Dozen of Candles, therefore 1 Dozen muſt be the *middle* Number of the ſecond Stating.

First, 3 Pieces, each 20 Ells, is 60 Ells in all.

```
Yard       s.  d.   Ells      s. d. Dozen £.  s. d.
If 1 ———— 3 - 9 ———— 60.   If 5 - 3 be 1—14 - 1 - 3
   4      12          5       12           20
  ——     ————        ——       ——          ————
   4      45,        300      63           281
           300                              12
         —————                            ————
       4)13500                        63)3375(53 Dozen
         —————                            315
     12) 3375 Pence                       ————
         —————                             225
     2|0) 28|1-3                           189
         —————                            ————
      £ 14 - 1 - 3 Iriſh coſt               36
                                           12in 1 Doz.
                                          ————
                                      63)432(6 Candles
                                           378
                                          ————
                                            54
```

Anſwer 53 Dozen and 6, that is, 53 Dozen and a Half. The Remainder 54, and all other Remainders, are placed Fraction-wiſe over the *Diviſor*, thus, $\frac{54}{63}$. So that the true Anſwer is 53 Dozen, and 6 Candles, and 54 ſixty-three Parts of another Candle, or $\frac{6}{7}$, which wants but $\frac{1}{7}$ of another whole one.

Tyro. I underſtand it all but the $\frac{6}{7}$ths, how do you make that out.

Philo. You will ſee better when you come to *Vulgar Fractions*; for $\frac{6}{7}$ths is the ſame as $\frac{54}{63}$. For divide the *Numerator* 54 by 9, and it is 6, for a *new Numerator*, and divide 63 the *Denominator* alſo by 9, and it is 7. But the Anſwer without the Fraction is near enough, and you muſt not mind theſe Curioſities at preſent.

Queſt. 18. A Woollen-Draper bought a certain Quantity of Serge and Broad-Cloth for £500: The Quantity of Broad-Cloth he bought was 500 Yards at 12*s.* 6*d.* *per* Yard. Now he bought 3 Times as many Yards of Serge as he did Broad-Cloth. I demand how much each coſt, and what the Serge coſt *per* Yard?

Firſt, I find what the Broad-Cloth comes to.

Yard. *s.* *d.* *Yards.*
If 1——12 - 6——500
12

150
500

12)75000

2|0) 625|0 Shillings

£312 - 10 *Anſ.* Broad-Cloth

£.
Both of them coſt 500 -
Broad-Cloth coſt 312 -

The Serge coſt 187 - 10

Here you ſee the Broad-Cloth coſt in all £312 - 10*s.* which taken out of £500 (what they both coſt) the Serge then muſt coſt in all £187 - 10*s.* Now the Queſtion ſays, he had 3 Times as many Yards of Serge as he had of Broad-Cloth, which is in all 1500 Yards, (that is, 3 Times 500) of Serge. Then to find how much the Serge coſt *per* Yard, I ſay,

Yards. *£.* *s.* *Yard.*
If 1500 coſt 187 - 10——1
20

3750
12

Firſt Number 15|00)450|00(30 Pence, or 2*s.* 6*d.* *Anſ.*
45 the Serge coſt *per* Yard.

0

Tyro. Sir, I am highly obliged to you; and I perceive, that it is nothing elſe but conſidering the Nature of the Queſtion, and two Statings are as eaſy done as one. But pray, if I may be ſo free, is not Intereſt caſt up, or done by the *Rule of Three.*

Philo. There is a ſhorter Way of doing it, but it may be done very eaſily; as alſo, *Exchange*, *Loſs* and *Gain*, *Barter*, *Fellowſhip*, and many ſuch like Rules, though they bear thoſe different Names, it is all but the *Rule of Three* in the Main: However, to ſatisfy you, I will give you an Example or two of each, to prepare you the better to work them.

1. *An* EXAMPLE *in* INTEREST.

Queſt. 19. What is the Intereſt of £ 360 for three Years, at £ 3 ½ (or £ 3 - 10*s.*) *per Cent. per Annum?*

Note, Remember that *per Cent.* ſignifies £ 100; ſo that in other Words it is thus: What comes the Intereſt of £ 360 to for 3 Years, at £ 3 ½ for every £ 100? Say,

```
     £.      £.   s.          £.
If 100——— 3 - 10————360
           20                 70
           ——                ————
           70          1|00)252|00
                           ————
                     2|0)25|2   Shillings
                           ————
                     £ 12-12   for 1 Year Anſ.
                            3   Years multiply
                           ————
                     £ 37-16   for 3 Years.   Anſ.
```

And after this Manner any Sum, at any Rate *per Cent.* may be done.

Note, When there are odd Months you muſt allow in Proportion, thus: Suppoſe it had been ſix Months more, you ſee one Year, or twelve Months, is £ 12 - 12*s.* therefore, ſix Months is half of it, *viz.* £ 6 - 6*s.* and 3 Months is £ 3 - 3*s.* more.

Queſt. 19. A Perſon left his Niece £ 650, to be paid to her when ſhe came to proper Age, with Intereſt upon it at 4 *per Cent.* Now it lay in the Executors Hands 219 Days, what had ſhe got to receive Principal and Intereſt in all.

Firſt, I find the Intereſt for one Year.

£. £. £. *Days* £. *Days*
If 100—4——650. If 365 be 26——219
4 26
£26|00 1314
438

I cut off 2 Cyphers, which is the ſame as divided by 100, and the Anſwer is £. 26 for one Year's Intereſt.

365)5694(15£.
365
2044
1825
219
20

Principal — £650 -
129 Days Intereſt is 15 - 12

Anſ. The Niece has £665 - 12 to receive.

)4380(12 Shill.
365
730
730

2. *An* EXAMPLE *in* Bartering, *or* Exchanging. *See* Queſtion 17.

Queſt. 21. Two Merchants *A* and *B barter*, or *exchange* with one another in Traffic. *A* has Sugar, which he ſells at £4 *per Cwt*. for ready Money; but in *Barter* he will have £4 - 13 - 4. *B* has Wine at £13 *per* Hogſhead: Now the Queſtion is how much *B* ought to advance his Wine in *Barter*, to equal the Advance of *A*'s Sugar.

Firſt, Sugar —— £4 - 13 - 4 in *Barter*
For ready Money —— 4 - -
£ - 13 - 4 Advance

£. s. d. £.
Then, If 4 Advance 13 - 4 —— 13
12
160 Pence
13
480
160
Firſt Number 4)2080
12) 520 Pence
2|0) 4|3 - 4
£2 - 3 - 4 *Anſ.*

Anſ. B muſt advance his Wine £2 - 3 - 4: So that in *Barter* his Wine is worth £15 - 3 - 4 *per* Hogſhead.

3. EXAMPLES *in* Profit *and* Loſs, *or* Loſs *and* Gain.

Queſt. 22. Bought 3 Pipes of Wine for 100 Guineas, one of which leaked, or ran out 23 Gallons; the Remainder I ſold at the Rate of 3 Half Crowns *per* Gallon; what was my Gain or Loſs?

Firſt, 1 Pipe is 126 Gallons
3
———
3 Pipes is 378 Gallons
23 leaked out
———
355 Gallons left

Gal. *s.* *d.* *Galls.*
If 1—7-6——355
12 90
———
90 12)31950
———
2|0)266|2-6
———
Sold for £133-2-6

Made of the Whole £133 - 2 - 6
Coſt 100 Guineas, *viz.* 105 - -
———
Gain —— —— £28 - 2 - 6 *Anſ.*

Quest. 23. What is gained *per Cent.* that is, what is gained in laying out £ 100, when 1 Shilling brings in 14*d.* $\frac{3}{4}$?

First 14*d.* $\frac{3}{4}$. *d.* *d.* £.

1 Shilling 12 If 12 gain 2$\frac{3}{4}$ —— 100

4 20

1 Shilling gains 2 $\frac{3}{4}$

11 2000 Shills.

12

24000 Pence

11

12)264000

4)22000

12)5500

2|0) 45|8-4

Gained *Anſ.* £ 22 – 18 – 4

Queſt. 24. A Gentleman that ſaw very plainly he could not live upon the common Intereſt of his Money, ſet up as common Brewer, and laid out £ 1000 for that Purpoſe, in fitting up an Office, and buying Utenſils; and Hops, Malt, Exciſe, Wages, and other Charges at the Year's End amounted to £ 4000 more; in which Time he ſold as much Beer as came to £ 6875. I demand what he gained in all, and how much he gained *per Cent.*

Firſt, Beer amounted to	——	£ 6875
His Charges are	——	5000
Gained in one Year	——	1875

£. £. £.
If 5000 gain 1875——100
100

*5|000)187|500

£ 37·—2500 remains
20

5|000)50|000

10 Shillings

Anſ. He gained in all £ 1875, which is £ 37·10*s.* *per Cent.*

* *Note*, I cut off 3 Cyphers in the *Diviſor*, and 3 Figures in the *Dividend* to anſwer them; then I divide 187 by 5, and it is 37, and 2 over, which, I place before the 500 that I cut off, makes 2500 remain, which I multiply by 20, and cut off 3 Cyphers, and divide by 5 only, gives 10 Shillings.

4. Ex-

4. EXAMPLES *in* Company *called* Fellowſhip.

Queſt. 25. Two Tradeſmen or Merchants, *A* and *B*, enter into Partnerſhip, and purchaſe one common Stock. *A* put in £ 1750, and *B* put in £ 1050; and they gain the firſt Year of Trading £ 800 clear; What is the Share of each, according to the Sum each advanced at firſt?

Rule. In all Queſtions of this Nature the Rule is, Add together what every Perſon firſt put into Stock; and then ſay, as the *whole Stock* is to the *Gain* or *Loſs*; ſo is what every Perſon ſeparately put in to his particular *Gain* or *Loſs*. That is, the *whole Stock* added together is your *firſt* Number; the *Gain* or *Loſs* your *ſecond* Number; and what every Man ſeparately put in is your *third* Number; and the different Anſwers, or *fourth* Number, will be every Man's proper Share.

The Work.

```
A put in  ———————  ———————  £ 1750
B put in  ———————  ———————    1050
                              ————
Whole Stock  ——————  ——————  £ 2800

    £.        £.       £.
If 2800 gain 800 ——— 1750   A's Stock
                      800
                    ———————
        28|00)14000|00(500 £.   A's Gain
              140
             ———————
               00
```

£. £. £.
Secondly, If 2800 gain 800 —— 1050 *B*'s Stock.
800
28|00)8400|00(300 £. *B*'s Gain.
84
00

Anſ. *A*'s Share of the Gain is —— £ 500
B's Sare is —— —— 300
Gain —— —— 800 *Proof*

☞ *Note*, If the *Gain* or *Loſs* be Pounds, Shillings, and Pence, reduce it accordingly, and your Anſwer will be of the ſame Name; and if there be Remains, add them together, and they will be always equal to the *Diviſor* if the Work be right, and you muſt carry one to the next Denomination when it happens ſo.

Queſt. 26. A Perſon broke, in Debt for £ 1890; but he gives up all his Effects to his Creditors, which amounted to £. 661 – 10*s.* how much then muſt each Creditor receive in the Pound?

Note, Had each Perſon's Debt been ſpecified, there muſt have been as many different Statings, but in this Caſe, but one, thus:

£. £. *s.* £.
If 1890 be 661 – 10 —— 1
20
1890)13230(7 Shillings in the Pound. *Anſ.*
13230
0

PROOF.

Debt. £1890

7

20)1323|0

£661 – 10 Effects

Now, ſuppoſe for Example's Sake, that any of the Creditor's Debt or Demand was £. 58, what muſt he receive? Say, If £ 1 be 7 Shillings, what will £ 58 be, and you will find it £ 20 - 6 for his Part; and ſo for the others, be they more or leſs.

Tyro. I am extremely obliged to you, Sir, for your explaining Things to me in this Manner.

Philo. I have no other Aim but your Advantage; nor ſhould I have been ſo long and particular, but that your Knowledge in this *Rule* is the Foundation of all the higher Rules, and even of the *Mathematics* itſelf. Thouſands of Examples more, 'tis true, might be given you; but as they depend upon what you have ſeen, and your conſtant Practice, I ſhall give you but one more, which in ſome Meaſure varies from the former ones.

Queſt. 27. A Wollen-Draper bought of a Clothier, an equal Quantity of four Sorts of Cloth, which coſt him £ 367 - 10*s.* Some coſt 18*s.* 6*d.* ſome 14*s.* 3*d.* ſome 11*s.* 6*d.* and ſome 4*s.* 9*d.* *per* Yard: How many Yards of each had he?

Rule. The Method of working all Sums of this Sort is this: Add all the different Prices together into one Sum, which is the *firſt* Number; then 1 Yard, or 1*lb.* &*c.* will be your *ſecond* Number, and the whole Sum laid out your *third* Number.

The Work.

s. *d.*
Firſt, I add all the different Prices thus: 18 - 6
14 - 3
11 - 6
4 - 9
£ 2 - 9 -

£. *s.* £. £. *s.*
If 2 - 9 —— 1 ———— 367 - 10
20 20
49 Shillings 49)7350(150 Yards of each, *Anſ.*
49
245
245
0

Tyro. I perceive the Nature of it plainly.

Philo. Indeed, *Tyro*, if you underſtand theſe Examples, you are able to ſolve any common Queſtion relating to Buſineſs.

N. B. My Intent, *Tyro*, was to have given you here a Notion of *Timber-meaſure*, and how to *gauge* a common Caſk, Cooler, or Piece of Malt, &*c.* or to meaſure any regular Piece of Ground; it being not only diverting, but alſo uſeful in the Country, and very ſatisfactory to Parents, when their Children have ſome Knowledge of theſe Things. But I ſhall reſerve this for a Dialogue by itſelf, and only leave you a few Queſtions for Practice.

QUESTIONS *to exercise the Learner in the* Rule of Three.

28. The Rents of a whole Pariſh amount to £1750, and a Rate is granted of £32 – 16 – 3; what is that in the Pound? *Anſ.* 4*d.* $\frac{1}{2}$.

29. A Bankrupt is indebted £2980 – 10*s.* but all his Effects amount but to £931 – 8 – 1$\frac{1}{2}$; what have his Creditors in the Pound? *Anſ.* 6*s.* 3*d.*

30. Bought a Lighter of Coals, containing 33 Chaldrons, 12 Buſhels, for which I gave £50; what do they lie me in *per* Buſhel? *Anſ.* 10*d.* Right

31. Bought of a Goldſmith 4 *lb.* 11 *oz.* 10 *dwts.* of Plate, at 5*s.* 4*d.* *per* Ounce; what does it come to? *Anſ.* £~~21 – 4~~ £15 : 17 : 04.

32. What is the Intereſt of £631 - 5*s.* for a Year, at 3 *per Cent?* *Anſ.* £18 – 18 – 9.

33. What comes the Commiſſion of £245 – 6*s.* to, at 2$\frac{1}{2}$ *per Cent?* *Anſ.* £6 – 2 – 7 $\frac{3}{4}$, $\frac{1}{5}$.

34. What muſt I give for the $\frac{6}{32}$ Parts of a Ship, that is worth £635 – 5*s.* *Anſ.* £119 – 2 – 2$\frac{1}{4}$.

35. Shipped for *Barbadoes* 500 Pair of Stockings, at 3*s.* 6*d.* *per* Pair, and 1650 Yards of Baize, at 15*d.* *per* Yard; and I have received in Return 348 Gallons of Rum, at 6*s.* 8*d.* *per* Gallon, and 750 *lb.* of Indigo, at 16*d.* *per lb.* what remains due upon my Adventure? *Anſ.* £24 – 12 – 6.

Rule. See what the Stockings and Baize come to, and add them together; then ſee what the Rum and Indigo both come to, and ſubtract it from the other, you'll find the Anſwer as above.

36. How many Bricks 9 Inches long, and 4 Inches wide, will floor a Room 18 Feet ſquare; that is, 18 Feet wide, and 18 Feet long?

Rule. Firſt, find the Content of the Room in Square Feet, that is, multiply the Length by the Breadth; then multiply that Product by 144, will bring it into Square Inches: This done, multiply the Length of the Brick by the Breadth, it is 36 Inches, which is your Diviſor. And the Anſwer is 1296 Bricks, 2 Thirds.

37. How many 10 Inch Tiles will floor a Malt Kiln 16 Feet long, and 14 Feet wide. *Anſ.* 322 $\frac{56}{100}$. *Rule,* Multiply 10 by itſelf, is the Contents of one Tile in Square Inches; then find the Contents in the Room in Inches, and divide by 100, it is 322, and better than a Half.

38. Bought a Ton of Iron, which coſt £ 19 - 10*s.* there being in Number 32 Bars: I deſire to know the Price of each, and what they weigh one with another. *Anſ.* 12*s.* 2*d.* $\frac{1}{4}$, and each Bar weighs 2 *qrs.* 14 *lb.*

39. There is a Ciſtern that holds 4 Hogſheads of Water, (allowing 63 Gallons to the Hogſhead) in which are placed two Pipes, the larger of which will diſcharge 1 $\frac{1}{2}$ Gallon every Minute; but if they both be ſet open they will diſcharge 2 $\frac{1}{4}$ Gallons every Minute: I demand in how long Time the Ciſtern will be filled by each Pipe alone, and in how long when they are both ſet open together. *Anſ.* Greater Pipe will fill it in 2 Hours, 48 Minutes; the ſmall one in 5 Hours, 36 Minutes; and both in 1 Hour, 52 Minutes.

40 There is a Steeple, which ſtands right upon level Ground, whoſe Shadow meaſures 75 Yards, at the ſame Time that the Shadow of a ſtraight walking Stick, which is a Yard long, meaſures 5 Feet: I demand the Height of the Steeple. *Anſ.* 45 Yards.

41. As I was beating on the Foreſt Grounds,
Up ſtarts a Hare before my two Grey-hounds:
The Dogs be light of Foot, did fairly run
Unto her 15 Rods, juſt 21.
The Diſtance that ſhe ſtarted up before
Was 4 Score, 16 Rods juſt, and no more:
Now this I'd have you unto me declare,
How far they ran before they caught the Hare?

Anſ, 336 Rods.

DIALOGUE VIII.

SECTION I.

The RULE *of* THREE *Inverſe, or* Reciprocal Proportion.

Tyro. WHAT do you mean by the *Rule of Three Inverſe?*

Philo. It is often called the *Rule of Three Reverſe*; that is, it is contrary to the *Rule of Three Direct.* For, as in the *Rule of Three Direct*, you multiply your *ſecond* Number by your *third*, and divide by your *firſt*; here you multiply your *ſecond* by your *firſt*, or your *firſt* by your *ſecond*, and divide by your *third*, and the *fourth Number* is the Anſwer.

Note, Your *third* and *firſt* Number muſt be of the ſame Name or Denomination, as in the *Rule of Three Direct*, and the *fourth* Number, or Anſwer, will be of the ſame Name as the *ſecond* Number.

Queſt. 1. How many Yards of Shalloon, 3 qrs. wide, will line 4 Yards of Cloth, which is 5 qrs. wide? *Anſ.* 6 Yards $\frac{2}{3}$.

As in the *Rule of Three Direct*, ſo here alſo, the *Queſtion*, or Demand, lies upon the *third* Number.

qrs. *Yards* *qrs.*
If 5——4——3
5 Firſt Number

3)20

Anſ. 6 $\frac{2}{3}$

Anſ. 6 Yards, and 2 remains, whice I place a-top of the 3, thus, $\frac{2}{3}$, and it is 2 Thirds. So is the Anſwer 6 Yards $\frac{2}{3}$.

Queſt. 2. If when Wheat is 3*s.* 6*d.* a Buſhel, the Three-penny Loaf weighs 4 *lb.* 2 *oz.* what ought it to weigh when the Wheat is 5 Shillings a Buſhel? *Anſ.* 2 *lb.* 11 *oz.*

s. *d.* *lb.* *oz.* *s.*
If 3 - 6——4 - 2——5
12 12 *oz.* 1 *lb.* *Troy* 12

42 Pence 50 60
42

100
200

6|0)210|0

12) 35 *oz.*

2 *lb.* 11 *oz.* *Anſ.*

Queſt. 3. A Regiment of Soldiers, conſiſting of 1000 Men, are to have new Coats, each containing 3 Yards, 2 qrs. of Cloth, that is, 6 qrs. wide, and they are to be lined with Shalloon that is Yard wide; how much Cloth will it take for their Cloaths, and how much Shalloon will line them? *Anſ*. 5250 Yards.

Firſt, ſee how much is in their Cloaths, thus:

1 Coat is 3 *Yards*. 2 *qrs*.
4
that is 14 *qrs*.
1000
14000 *qrs*. in all

qrs. *qrs*. *Yard*.
Then, If 6 —— 14000 —— 1 Shalloon
6 4 *qrs*.
Third Number 4)84000
4)21000 *qrs*.
5250 Yards. *Anſ*.

Queſt. 4. An Acre of Land contains (according to the Table) 40 Rods in Length, and 4 in Breadth, what muſt be the Length to make an Acre, when the Breadth is 15 Rods?

Breadth *Length* *Breadth*
If 4 —— 40 —— 15
4
———
15)160(10 Rods
15
———
10
$5\frac{1}{2}$ Yards 1 Rod
———
15)55(3 Yards.
45
———
10
3 Feet
———
15)30(2 Feet
30
———
0

Rods *Yds.* *Feet*
Anſ. 10 - 3 - 2

Queſt. 5. If £ 100 in 12 Months gain £ 4 Intereſt, what Principal will gain as much in 8 Months? *Anſ.* £ 150.

Months *£.* *Months*
If 12 —— 100 —— 8
12
———
8)1200
———
£ 150 *Anſ.*

Queſt. 6. An Army of Soldiers conſiſting of 800, beſiege a Town, having with them Proviſion for 3 Months; but as they could not take the Town in that Time, the General was willing to make the ſame Proviſions laſt 5 Months, allowing each Man the ſame daily Proviſion: The Queſtion is, how many Men muſt there be that the Proviſion may laſt them 5 Months?

Months *Men* *Months*
* If 3——800——5
3
5)2400
480 *Anſ.*

Men
800 for 3 Months
480 for 5 Months
320 Diſcharged

The laſt QUESTION *varied.*

* *Note*, This Queſtion is ſet in Words on Purpoſe, *Tyro*, to puzzle you; but you muſt obſerve, that in all ſuch Sort of Sums, the Circumſtance of what is done is never to be minded: For, Suppoſe I ſhould ſay thus:

If 800 Men in 3 Months eat 10000 Penny-Loaves; how many will eat the ſame in 5 Months, at that Rate? *Anſ.* 480 Men, as before: So that the Action, or Circumſtance of what they do is Nothing, let it be Eating, Drinking, or any other Thing.

Tyro. I underſtand you, Sir, and thank you for this Obſervation; and I think you have given me ſufficient Examples.

Philo. All other Queſtions are done after the ſame Manner. If you are perfect in theſe, you will eaſily do the following ones.

QUESTIONS *to exerciſe this* RULE.

Queſt. 7. If when Wheat is ſold for 3*s.* 9*d.* a Buſhel, the Six-penny Loaf weighs 5 *lb.* 10 *oz.* How much ought it to weigh when it is Half a Crown a Buſhel? *Anſ.* 8 *lb.* 9 *oz.*

Queſt. 8. How many Yards of Matting, that is 2 Feet wide, will cover a Room 20 Feet long, and 18 Feet wide. *Anſ.* 189 Feet, or 60 Yards.

Queſt. 9. How many Yards of Paper, 3 qrs. wide, will be ſufficient to hang a Room that is 24 Yards round, and 4 Yards high? *Anſ.* 128 Yards.

Tyro. Theſe Queſtions are ſufficient, Sir.
Philo. Then we will proceed to *Section* 2.

SECTION II.

Of Plural Proportion, *called the* Double Rule of Three Direct.

Tyro. WHAT is *Plural Proportion,* or the *Double Rule of Three Direct?*

Philo. Plural Proportion is when 5 Numbers are given to find a Sixth; which ſix Numbers, or Anſwer, is found by two Statings of the *Single Rule of Three Direct.*

Tyro. This is very difficult I imagine; for, how am I to know how to make the firſt Stating.

DEFINITION *and* RULE.

Philo. In every regular Sum in the *Double Rule of Three Direct,* the firſt 3 Numbers always ſhew the Condition, or Suppoſition; and the other two, that is, the two laſt, ſhew the Demand. The Anſwer of the Queſtion will always be the ſame as the *middle* Number; and the *firſt* and *third* muſt be of the ſame Name in both Statings, like as in the *Single Rule of Three Direct.*

Tyro. Cannot theſe Queſtions be done at one Stating?

Philo. Yes, by a Rule generally called the *Rule of Three of 5 Numbers*, and that with a great deal more Eaſe, as you ſhall ſee by and by; but we will give an Example here.

Queſt. 1. If £.100 in 12 Months gain £4 Intereſt; what will £175 gain in 9 Months. *Anſ.* £5 – 5*s*.

£. £. £.
First, If 100 gain 4 what —175
4
——
1|00)7|00
——
£7

Here I find £175 gains £7 in twelve Months. Therefore, I ſay in the ſecond Stating.

Months £. *Months*
If 12 —— 7 —— 9
9
——
12)63
——
£.5 —— 3 remains
20
——
Same Diviſor 12)60
——
5 Shillings

Or thus,

You may begin with the *ſecond*, *third*, and *fifth* Numbers.

Months £. *Months*
Firſt, If 12—be—4———9 *Anſ.* £.3.

£. £. £.
Then, If 100—3———175 *Anſ.* £.5-5.

Note, See the Proof of this Queſtion in the firſt Example of the next *Rule Inverſe*.

Queſt. 2. If 600 Seamen in one Week eat 1500 *lb.* of Beef; how many *lb.* will ſerve 120 Seamen 12 Weeks? *Anſ.* 3600 *lb.* See *Example* 2, in the next Rule.

All Queſtions in this Rule being done after the ſame Manner, I ſhall leave other Examples for the *Rule of Three of five Numbers*, by which they are done with more Eaſe; and ſhall only give you a Notion of ſtating Queſtions here and in the *Double Rule of Three Inverſe*.

A RULE *to ſtate, or know the Nature of a Queſtion, and to know of the Certainty of your three firſt Numbers, and the Name of the Anſwer.*

You know there are *five* Numbers given to find out a *Sixth*; mind then you carefully obſerve what Name your Anſwer is to be in: This being done, place your 5 Numbers in 2 Rows, *viz.* 3 in the firſt Row, and 2 under them, leaving a blank Space under that Number which is of the ſame Name as your Anſwer is to be in; ſo will you ſee both here, and in the next Rule, the Order of both theſe *Double Rules of Three, Direct and Inverſe*.

Take the firſt Queſtion, where your Anſwer is in Pounds, and rank the Numbers thus, as the Queſtio itſelf runs.

If £. 100 — 12 Months £. 4.
£. 175 — 9 Months *

* Here you ſee the Blank, or vacant Place, is *Money*; therefore, Money muſt be your middle Number of the three, and Money will be the Anſwer. *Note*, The Blank muſt fall under the Suppoſition, which here is £. 4.

Second QUESTION.

If 600 Seamen—1 Week—1500 *lb.*
120 Seamen—12 Weeks *

* This *third* Number in the ſecond Row has a Blank Place under you ſee, according to the Order of the Sum; therefore, 1500 *lb.* muſt be your *ſecond* Number in the firſt Stating, and your Anſwer will alſo be *lbs.*

Tyro. I humbly thank you, Sir.

Philo. There are many other Ways of varying this Rule; but this is ſufficient for your Purpoſe at preſent. See the *Rule of* 5 *Numbers.*

SECTION III.

The Double Rule of Three Inverſe, *called alſo* Plural Proportion.

Tyro. WHAT is the Difference between this Rule and the laſt?

Philo. A great deal: For though here be 5 Numbers given to find a *ſixth*, yet you will find it much more difficult to *ſtate* the Queſtion here than in the other; but obſerve the following Direction.

RULE.

1. As in the *Double Rule Direct*, ſo alſo here are 3 Numbers in the Suppoſition, and 2 in the Demand.

2. Place the Numbers in Order, as in the laſt Rule, *viz.* 3 in one Row, and 2 in the next, leaving that Number with a blank Place under, which will be the ſame Name of your Anſwer, obſerving well where the Suppoſition lies.

3. This being done, you ſtate the Queſtion with 3 Numbers firſt, as before; which is wrought according to the *Single Rule of Three Inverſe*.

☞ If your firſt Stating be *Direct*, the ſecond muſt be *Inverſe*; for both are never *Direct*, nor never *Inverſe*.

Queſt. 1. If £100 Principal* in 12 Months gain £4 Intereſt, what Principal will gain 5 Guineas (*viz.* £5 - 5*s.*) in 9 Months? *Anſ.* £175 Principal.

* *Note,* The Word *Principal* ſignifies the Money put out to Intereſt.

Here you ſee, there are 3 Numbers in the Suppoſition, *viz.* £100, 12 Months, and £4; and 2 in the Demand, *viz.* £5 - 5*s.* and 9 Months.

Now obſerve, That one of theſe two in the Demand muſt be the laſt Number in the *firſt Stating*, and the other, the laſt in the *ſecond Stating*, and one muſt be always *Inverſe*.

Mths. £. Mths.
Firſt, Inverſe. If 12——100——9

Multiply £100 by 12, and divide by 9, you have £133 $\frac{1}{3}$, *viz.* £133. 6*s.* 8*d.* Then,

£. £. *s.* *d.* £. *s.*
Secondly, Direct. If 4——133 - 6 - 8——5 - 5.

Here I reduce the *firſt* and *laſt* Numbers into Shillings, the *ſecond* into Pence, and by the *Rule Direct*, I find the Anſwer £175, the Principal required.

2. *Or thus:*

£. £. £. *s.*
1. *Direct.* If 4——100——5 - 5. *Anſ.* £131-5*s.*

Mths. £. s. Mths.
2. *Inverſe.* If 12——131 - 5——9. *Anſ.* £175, as before.

Queſt. 2. If 600 Seamen in 1 Week eat 1500 *lb.* of Beef, how long will 3600 *lb.* ſerve 120 Men at that Rate.

Men *Weeks* *lbs.*
Here, If 600 —— 1 —— 1500
3600 *lb.* * 120 Men

Men Week Men
Firſt, Stating *Inverſe*. If 600—1—120 *Anſ.* 5 Weeks.
Secondly, *Direct*. If 1500—5—3600 *Anſ.* 12 Weeks.

* See the Second Queſtion of the laſt Rule.

Tyro. I underſtand it a little, but cannot ſay I am perfect in it.

Philo. It is of no great Signification at preſent; for you will ſee more of it in the the next Rule.

SECTION IV.

The Rule of Three *compoſed of* Five Numbers.

Tyro. WHAT Difference is there between this and the other two preceding Rules?

Philo. Only this, that all Queſtions in the *Double Rule of Three Direct* and *Inverſe*, are performed here at one Stating.

Tyro. So you ſaid before, I remember; pleaſe, therefore, to give me a Rule to work it by; for I think that is much better than the Trouble of two Statings.

Philo. It is ſo in general, but not always: However, it is eaſier, and better for the Learner upon the whole; for here, as well as in the two former Rules, the Difficulty lies to know whether the Queſtion be *Direct*, or

Inverſe. This being known, the Manner of ſtating th Queſtion will be eaſy, and the Work as eaſy.

A ſtanding Rule to ſtate Queſtions.

1. As in the *Single Rule of Three Direct*, ſo alſo here, the *middle Number* governs the Queſtion; and the Anſwer will be of the ſame Name.

2. Having noted which the *middle Number* is, the other 4 are eaſily known; for the *two* that are in the Suppoſition always are the *two* before the *middle Numbers*; the other *two* are the Demand under the *third* and *fourth* Numbers.

Laſtly, Always obſerve, that your *firſt Number* [illegible] of the ſame Name as your *fourth*; and your *ſecond Number* the ſame Name as your *fifth*. This being done,

1. *The Rule for all* Direct *Queſtions is this.*

Multiply your *firſt* Number by your *ſecond*, for a *Diviſor*, then multiply your *third*, *fourth*, and *fifth* together, and divide their Product by the Product of the *firſt* and *ſecond*; and the *Quotient* will be of the ſame Name as the *middle Number*, be it what it will, and is the *Anſwer*.

EXAMPLE. *The firſt Queſtion of the two laſt Rules.*

Queſt. 1. If £100 in 12 Months gain £4 Intereſt, what will £175 gain in 9 Months. *Anſ.* £5 - 5*s*.

£. Months £. £. Months
If 100—12 gain 4 —175—9
12 9
1200 1575
4
12|00)63|00
£3 - 3 remains
20
12)60
5 Shillings

Anſ. £5 - 5*s*. See the firſt Example of the laſt Rules.

Queſt. If 600 Seamen, in 1 Week, eat 1500 *lb.* of Beef; how many *lb.* will ſerve 120 Seamen 12 Weeks?

Men Week lb. Men Weeks
If 600—1—1500—120—12
1 120
600 180000
12
6|00)21600|00
3600 *lbs. Anſ.*

See *Example* 2, in the *Double Rule Direct.*

Another Rule for the more eaſy ſtating a Queſtion.

1. *Note*, If you obſerve the two foregoing Examples, they are ſtated juſt as the Numbers follow one another in the Words of the Queſtion; but it very often happens that the Numbers in the Sum lie contrary to the Order they ought to be placed in; therefore, you ſhould turn the Queſtion into other Words and it will be eaſier. Or,

2. Set all the Numbers down as they run in the Queſtion, writing the Names over each; then conſider what your Anſwer is to be in, and place that down afreſh for the *middle Number*; then the *two* where the Demand lies muſt be your *fourth* and *fifth*, and the other *two* your *firſt* and *ſecond* Numbers: The *firſt* muſt be the ſame as the *fourth*, and the *ſecond* the ſame as the *fifth*. See the next *Queſtion*.

Queſt. 3. If £4 be the Wages of 8 Men 10 Days, what will it coſt me, or what muſt be the Wages of 32 Men 12 Days? *Anſ.* £19 – 4*s.*

Here, as before directed, I place the Numbers after one another, thus:

£. *Men* *Days* *Men* *Days*
If 4——8——10——32——12. wrong ſtated.

Now, here the *middle Number* is Days, but ſhould be Money, becauſe the Queſtion ſays, What will it coſt me, for 32 Men 12 Days; therefore Money muſt be my middle Number, and then, *Tyro*, the true *Stating* will appear eaſy as follows.

Men *Days* £. *Men* *Days*
Thus*, 8——10——4——32——12. *Anſ.* £19 – 4*s.*

Now here, *Tyro*, the Stating runs like the Words of the Sum, as follows, which is very natural.

* If 8 Men in 10 Days coſt me £4 for Wages, what will 32 Men coſt me in 12 Days, at that Rate? *Anſ.* as before.

K 5 *Queſt.*

Queſt. 4 (*A Proof of the firſt Queſtion in the laſt Rule*) A Perſon put out 175 Pounds to receive Intereſt, and when it had continued 9 Months, he received Principal and Intereſt together £180 – 5s. I demand at what Rate *per Cent. per Annum*, he put his Money out at? *Anſ.* £4 *per Cent. per Annum.*

Here the Words of the Queſtion are not like the *Stating*. You muſt obſerve then to proceed as under, in all Queſtions of this Nature.

Rule. Take the Principal from the Intereſt and Principal together, the Remainder will be the Intereſt for the Time it continued, and then the Stating will follow,

Thus,	Principal and Intereſt	£180 – 5s.
	Principal put out ——	175 –
	Intereſt for 9 Months —	£5 – 5s.

£. Months £. s. £. Months
If 175—9 gain 5 – 5 Intereſt, what will 100 in 12

Here, according to the Rule, bring your *middle Number* into Shillings; then multiply it by your *fourth* and *fifth*, for a *Dividend*; this done, multiply your *firſt* and *ſecond* together for a *Diviſor*, and the Quotient will be 80 Shillings, or £4, the Rate he put the Money out at.

Tyro. I heartily thank you; and I find by this I ſhall be able to anſwer Mr. *Cocker*'s laſt Queſtion in the *Double Rule of Three Direct*, which before always appeared very difficult to me.

Philo. You ſay very right, *Tyro*, for the Queſtion is done after the very ſame Manner; therefore, I ſhall give you only two or three Examples in the *Double Rule of Three Inverſe*, and leave you to practice the other Examples.

QUESTIONS *Inverſe.*

2. The Rule for *Queſtions Inverſe* is as follows: The 3 Numbers belonging to the Suppoſition muſt be your *firſt*, *ſecond*, and *third* Number, and the Demand is your *fourth* and *fifth* Number. Theſe being obſerved, the Rule is, Multiply your *ſecond*, *third*, and *fourth* together for a *Dividend*, and your *firſt* and *fifth* together for a *Diviſor*, and the *Quotient* is the ſame Anſwer as your *middle Number.*

Queſt. 1. (*A Proof to the very laſt Queſtion, and of Queſtion* 1 *in the laſt Rule*) If £100 in 12 Months gain £4 Intereſt, what Principal will 5 Guineas gain in 9 Months?

Here, as the Principal is to be the Anſwer, ſo the Principal (*viz.* £100) muſt be your *middle Number.*

£. *Months* £. £. *s.* *Months*
If 4—12 be 100 Principal, what 5 - 5 be 9 *Anſ.* 175.

I ſtate the Queſtion according to the firſt ſtanding Rule, making my *firſt* and *fourth*, and my *ſecond* and *fifth* alike; this done, I bring my *firſt* Number into Shillings (*viz.* 80) becauſe the *fourth* muſt be brought into Shillings: This being done, I multiply the *ſecond*, *third*, and *fourth* together for a *Dividend*, and the *firſt* and *fifth* together for a *Diviſor*, and the *Quotient* is £175, the Principal required.

Queſt. 2. If 600 Seamen in 1 Week eat 1500 *lb.* of Beef, how long will 3600 laſt 120 Seamen?

lb. *Men* *Week* *lb.* *Men.*
If 1500——600——1——3600——120.

Here I multiply the *ſecond*, *third*, and *fourth* together for a *Dividend*, which is 2160000, and my *firſt* and *fifth* for a *Diviſor*, which is 180000, and the *Quotient* is 12 Weeks.

Queſt. 3. If it coſt me £. 240 for 60 Servants in 8 Weeks, how long will £ 140 ſerve me for 8 Servants? *Anſ.* 7 Weeks.

Wrong

Tyro. Sir, theſe Examples are ſufficient, I think.

Philo. If you are well grounded in the Nature of the Rule, that is enough; for you may ſet yourſelf Sums at any Time by Way of Exerciſe. And now, *Tyro,* I will give you a Notion of *Tare* and *Trett.*

SECTION V.

TARE *and* TRET.

Tyro. WHAT do you mean by *Tare* and *Tret?*

Philo. *Tare* and *Tret* are Allowances made in buying and ſelling Commodities that are liable to Loſs or Waſte.

Tyro. What are the general Names belonging to this Rule.

Philo. They are 6, *viz.* *Groſs, Tare, Tret, Suttle, Cloff,* and *Neat.*

Tyro. Pleaſe to explain theſe in their Order.

Philo. *Firſt, Groſs* ſignifies the whole Weight of any Commodity, or Parcel of Goods, Bag, or Box, or Caſk, and all included, thus: Suppoſe I had a Box of Tea, Bag of Spice, or Caſk of Oil, which weighs 120*lb.* I ſay it weighs 120 *lb. Groſs.*

Secondly, Tare is an Allowance made for the Weight of the Box, Bag, or Caſk, and what hangs about it, and is to be taken out of the *Groſs,* and then the Remainder is called the *Neat,* or *Clear Weight* of the Commodity: Thus, Suppoſe the foregoing Box, Bag, or Caſk, after the Goods are out, ſhould weigh 16 *lb.* then I ſay, I ſay, it has 16 *lb.* *Tare*, which I ſubtract out of the *Groſs* 120 *lb.* there remains 104 *lb.* ***Neat***, thus:

Bought a Box of Tea,	*Groſs*	120 *lb.*
	Tare	16 *lb.*
	Neat	104 *lb.*

Thirdly, *Tret* is an Allowance of 4 *lb.* for every 104; that is, 1 *lb.* is allowed for every 26 *lb.* for ſuch Commodities as are liable to Waſte, Moths, Duſt, *&c.*

Note, When there is *Tret* in the Sum, then after the *Tare* is taken from the *Groſs*, the Remainder is called *Suttle*, inſtead of *Neat*.

Note 2. To find the *Tret* Pounds, divide the *Suttle* Pounds by 26, and the *Quotient* in the *Tret*, which ſubtracted from the *Suttle* gives the *Neat*.

Thus, A Box of Tea,	*Groſs*	120 *lb.*
	Tare	16
26)104(4 *Tret*		
104	*Suttle*	104 *lb.* which divide by 26
	Tret	4 *lb.*
0		
	Neat	100 *lb.*

Fourthly, *Suttle* Pounds are ſo called (as was ſaid before) when there is *Tret* in the Sum; for when there is no *Tret* there is no *Suttle*, and the *Tret* Pounds are always ſubtracted out of them, as in the above.

Fifthly, *Cloff* is an Allowance of 2 *lb.* for every 3 *Cwt.* for the Turn of the Scale, and for ſmall Draughts; but this is allowed only in ſome particular Things, and Caſes.

Sixthly, *Neat* Weight is the *clear* Weight of the Commodity after all the Allowances are made.

Tyro. Sir, I underſtand you very well; but, if I remember, you told me, (in *Page* 163) you would ſhew me a ſhorter Method to reduce *Cwts.* and *qrs.* into *lbs.* than you did in *Page* 170.

Philo. I did ſo; and will now ſhew you all the Ways, and leave you to take your Choice.

To reduce Hundreds *and* Quarters *into* Pounds.

EXAMPLE 1. Reduce 17 *C.* 3 *qrs.* 15 *lb.* into *lbs.*

C. *qrs.* *lb.*
Firſt Method 17 – 2 – 15
4
———
71
Common Way 28
———
573
143
———
Anſ. 2003 *lbs.*

C. *qrs.* *lbs.*
Second Method 17 – 3 – 15*
17
17
17
Add 99 for the 3 *qrs.*
——— 15 *lbs.*
Anſ. 2003 *lb.* *See p.* 120.

* *Note*, In this Method you muſt always ſet the *C*'s down 4 Times, *viz.* twice under one another, and the other two, each one place more towards the Left-hand; then count how many *lbs.* there are in the odd *qrs.* and *lbs.* (which here are 99) and always place them under the *Units*, *Tens*, as above, and adding them together, you have the *Anſwer*.

Note, This Method is ſhorter than the *firſt*, and more particular when there are many Figures in the given *Hundreds*.

Third Method. Multiply by 112, and take in the odd Pounds.

C. *qrs.* *lb.* C. *lbs.*
17 - 3 - 15 is 17 and 99
112

Anſ. 2003 *lbs.*

* Here I multiply by 112 in 1 Line, thus: I ſay, 12 Times 7 is 84, and 9 odd *lbs.* make 93, 3, and I carry 9; then 12 Times 1 is 12, and 9 I carried is 21, and the other 9 I take in alſo is 30, that is 0, and I carry 3. *Laſtly*, I ſay, once 17 is 17, and 3 I carried is 20, which I place by the Side of the other 2 Figures, and it is done.

This is alſo ſhorter than the *firſt Method*, but ſomething more difficult till you learn to multiply by 112 very well, as you will ſee in *Example* 2.

☞ *Fourth Method.* The beſt Way (in my Opinion) is this laſt Method, which is this: Multiply the *C*'s by 12 only, always remembering to place the two firſt Figures out towards the Right-hand; then ſet the odd Pounds under, and add them together as they ſtand, it is done.

C. *qrs.* *lbs.* C. *lbs.*
Thus, 17 - 3 - 15 is 17 - 99 **
204
99

Anſ. 2003 *lbs.* as before

There is no Occaſion to ſet down the 12 under the 17, when you multiply; for it is eaſy to remember you multiply by 12. I ſay then, 12 Times 7 is 84, (which 4 I place 2 Figures towards the Right hand of the 17) that is 4, and I go 8; then 12 Times 1 is 12, and 8 is 20, which I place to the Left of the 4, ſo that the 2 falls under the 7; then I ſet down the 99 odd Pounds, and add them together, they make 2003 *lb.*

** *Note*, But you may do it yet ſhorter by Uſe, and full as eaſy, and that is by taking in the 99 as you multiply, which will ſave the Trouble of adding it afterwards.

C. *lb.*
Thus, 17—99
303
———
2003

Here I ſay, 12 Times 7 is 84, and 9 is 93, 3, and I carry 9; 12 Times 1 is 12, and 9 I carry is 21, and the laſt 9 belonging to the 99 makes 30.

Now, the Reaſon of this will appear plain, if you conſider that 17 *C.* is 1700 *lb.* and and 17 Times 12 *lb.* therefore, I only ſet down 1700 *lb.* and add 12 Times 17 to it.

Thus, 17 *C.* is —— 1700
More, 12 Times 17 is 204 add
———
Anſ. 1904 *lb.* in 17 *C.*

1700—99 *lb.*
So alſo 303 is 12 Times 17, and 99.
———
2003 as before

☞ *Note*, Or you may do it ſhorter yet, only by putting or joining the odd *lbs.* by the Side of the *C*'s (making a Dot between them for Diſtinction Sake) then multiply the *C*'s only by 12; placing 2 Figures out from them, as before directed, and you have the Anſwer, which will ſave the Trouble of taking in.

```
        C.   lb.               C. lb.
Thus, 17 - 99 I ſet down 17.99
                           204
                          ----
                    Anſ. 2003 lb.
```

Here I multiply 17 only by 12, always placing the two firſt Figures to the Right-hand; then add the two Lines together.

Example 2. In 47 *C.* 1 *qr.* 26 *lb. Neat*, how many *lbs*?

```
     C.   qr.  lb.    C. lb.
Here 47 - 1 - 26 is 47.54 multiply 47 only by 12.
47 multiplied by 12 is  564
                       ----
                       5318 Anſ.
```

Example 3. In 86 *C.* 1 *qr.* 17 *lb. Neat*, how many *lbs*?

```
     C.   qr.  lb.    C. lb.
Here 86 - 1 - 17 is 86.45
86 multiplied by 12 is 1032
                       ----
                       9686 Anſ.
```

Here I join the odd 45 *lb.* cloſe to the 86 *C.* and then multiply 86 only by 12, placing two Figures out as before.

Tyro. Very well Sir, I underſtand what you have ſhewn me; but ſuppoſe the odd Pounds amount to three Figures, may I join them to the *C*'s then?

Philo. No, only 2 of them; and place the other Figure (which will always be 1) under the Units Place of the *C*'s, as in the following Example.

Example 4. Reduce 89 *C.* 3 *qrs.* 21 *lbs. Neat*, into *lbs.*

That is, 89 *C.* and 105 *lb.* Thus,	89.05
	*1
89 multiplied by 12 is ——	1068
Anſ.	10073 *lb.*

* Here 3 *qrs.* 21 *lbs.* is 105 *lbs.* and becauſe there are three Figures, I place the 1 under the 9, and thus for all ſuch Examples.

Now, *Tyro*, I will prove this laſt Example by the other three Methods, and leave you to take your Choice as Practice or Fancy direct.

C. qrs. lbs.	*C. lbs.*	*C. lbs.*
89 - 3 - 21	*Secondly*, 89-105	*Thirdly*, 89-105*
4	89	112
	89	
359	89	10073 *lbs.*
28	105	
2873	10073 *lb.*	
720		
10073 *lb.* Common Way		

* This third Method is certainly very ſhort, if once you can multiply well by 112: For obſerve, I ſay 12 Times 9 is 108, (and 5 the odd *lbs.*) is 113; 3, and I carry 11; then 12 Times 8 is 96, and 11 is 107, and the 10 *lb.* is 117, that is 7, and I carry 11; *laſtly*, I ſay once 89 is 89, and 11 I carried is 100.

Tyro. Sir, I heartily thank you; I ſee now how it is done.

Philo. Then I will give you one Example at large.

Example 5. Bought 3 Hogſheads of Sugar, as under.

		C.	*qrs.*	*lbs.*
Groſs	N° 1	11	2	15
	2	15	1	17
	3	17	3	14
Groſs		44	3	18
Tare		1	1	2
Suttle		43	2	16

Tare of all 1 *C.* 1 *qr.* 2 *lbs.* *Tret* 4 *lb.* for every 104, at 50 Shillings a *C. Neat*, what come they to?

lbs.
26)4888(188 *Tret*
26
228
208
208
208

Suttle lbs.	4888	*lbs.*
Tret	188	*lbs.*
Neat	4700	*lbs.*

Then, If $\overset{\text{C.}}{1}$ *viz.* $\overset{\text{lb.}}{112}$ coſt 2*l.* 16*s.* what coſt 4700 *lbs. Neat?* *Anſ.* £ 117 – 10*s.*

Example 2. Bought 3 Caſks of Tea, each weighing *Groſs*, 1 C. 3 *qrs.* 12 *lbs.* *Tare* of each 1 *qr.* 5 *lb.* at 4*s.* 9*d.* a *lb. Neat*: What come they to?

Here being no *Tret*, the *Tare* taken out of the *Groſs* the Remainder is *Neat*. *Anſ.* £151 – 5 – 9.

Tyro. I am highly obliged to you, Sir; and am now ready for the next Rule, if you pleaſe.

Philo. The next Thing I ſhall inſtruct you in is the Rule of *Practice*.

DIA-

DIALOGUE IX.

SECTION I.

Of PRACTICE.

Tyro. WHAT do you mean by *Practice?*

Philo. *Practice* is only *Diviſion of Money*, and very much reſembles *Reduction aſcending*; for here you divide by as many of the *Leſs* as make one of the *Greater*. It is a ſhort contracted Way of the *Rule of Three Direct*, and ſaves the Trouble of ſtating Queſtions, by dividing by the Parts contained in the Whole.

Tyro. Are not *Vulgar Fractions* often taught before *Practice?*

Philo. They are; but there is no Neceſſity for it; if you can read a Fraction that is enough. Thus, $\frac{2}{7}$, $\frac{3}{4}$, $\frac{1}{8}$, or $\frac{1}{12}$, are thus read, 2 *Sevenths*, 3 *Fourths*, 1 *Eighth*, and 1 *Twelfth*.

Tyro. I know this very well Sir.

Philo. Then you may proceed to work this Rule as ſoon as you pleaſe; but it will be neceſſary to learn the following Tables by Heart.

TABLE 1.

Even Parts of a Shilling.

Pence		
6	is	$\frac{1}{2}$ of a Shill.
4		$\frac{1}{3}$
3		$\frac{1}{4}$
2		$\frac{1}{6}$
1$\frac{1}{2}$ *qrs.*		$\frac{1}{8}$
1		$\frac{1}{12}$
$\frac{3}{4}$		$\frac{1}{16}$
$\frac{1}{2}$		$\frac{1}{24}$
$\frac{1}{4}$		$\frac{1}{48}$

TABLE 2.

Even Parts of a £. Sterling.

Shillings		
10	is	$\frac{1}{2}$ of a £.
6-8*d.*		$\frac{1}{3}$
5		$\frac{1}{4}$
4		$\frac{1}{5}$
3-4*d.*		$\frac{1}{6}$
2-6*d.*		$\frac{1}{8}$
2		$\frac{1}{10}$
1-8*d.*		$\frac{1}{12}$
1-3*d.*		$\frac{1}{16}$
1		$\frac{1}{20}$

Tyro. I will learn theſe Tables as faſt as I conveniently can.

Philo. Very well; then I ſhall proceed to give you Examples under the following *Caſes.*

CASE 1.

When the Sum is given in Farthings, that is 1, 2, or 3 Farthings *per lb.* or Yard; then only bring theſe Farthings into *Pence, Shillings,* and *Pounds,* and the Work is done.

$\frac{1}{4}$	$\frac{1}{4}$	1753 *lb.* at $\frac{1}{4}$ a *lb.*
1*d.*	$\frac{1}{12}$	438-$\frac{1}{4}$
1*s.*	2|0	3|6 - 6*d.*
		£1-16-6$\frac{1}{4}$ *Anſ.*

Here 1753 lbs. at a Farthing a lb. is 1753 Farthings; therefore, I only divide by 4, by 12, and by 20, and have £1-16-6¼ for Anſwer.

Any

½*ny*	½	1753 *lb.* at ½*ny* a *lb.*
1*d.*	1/12	876 – ½
1*s.*	2|0	7|3 –
		£3 – 13 – 0½ *Anſ.*

Here 1753 is 1753 Halfpence. I divide therefore by 2 to bring them into Pence, and by 12, and 20, to bring them into £'s, and the Anſwer is £3–13–0½, which is juſt double the firſt Sum, at a Farthing a lb. and is a Proof to it.

*¾	⅛	1753 *lb.* at ¾ *per lb.*
6*d.*	½	219 – ¾
1*s.*	2|0	10|9 – 6
		£5 – 9 – 6¾ *Anſ.*

Here I ſay 3 Farthings is the 1 Eighth of 6 Pence, and dividing by 8, I have 219 Six-pences, and 3 Farthings over; then I divide by 2 (becauſe 6d. is ½ a Shilling) and have 109 Shillings, and 6d. over; then I divide by 20, to bring them into £'s, and have £5 – 9 – 6¾,

Note, If you add the Anſwers of the *firſt* and *ſecond* Sum together, you will find they amount to £5 – 9 – 6¾ which proves the Work.

* There is another Way to do this. Multiply 1753 by 3 Farthings, and the Product is Farthings; then divide by 4, 12, and 20.

		1753 *lb.* at ¾ *per lb.*
		3
4		5259
12		1314 – ¾
2|0		10|9 – 6
		£ 5–9–6¾ *Anſ.*

d.		*Yards*
1	$\frac{1}{12}$	1753* at 1*d. per* Yd.
	2|0	14|6 – 1
		£ 7–6–1 *Anſ.*

* *Note*, I make Uſe of the ſame Number, 1753, becauſe you may prove the Work of one Sum by another, by adding the Products of any two together, thus; the Product of 3 Farthings and 1 Farthing will prove the laſt Sum of a Penny.

CASE 2.

When the given Price is Pence and Farthings, then take the Parts for the Pence firſt, and then the Parts for the Farthings.

d.		*Ells d.*
1	$\frac{1}{12}$	1753 at 1 ¼ *per* Ell
¼	¼	146 – 1*d.*
		36 – 6¼ **
	2|0	18|2 – 7¼
		£9 – 2– 7¼ *Anſ.*

** Here, I ſay 1 Penny is the $\frac{1}{12}$ of a Shilling; then I ſay, 1 Farthing is the ¼ of a Penny, and dividing 146 Shillings by 4, I have 36 Shillings, and 2 remains, which is 2 Shillings; then I ſay, the 4th of 2 Shillings is 6*d.* and the 4th of a Penny is ¼; then I add them both together, which make 18*s.* 7*d* ¼, and dividing by 20, I have £9–2–7¼ for *Anſ.*

☞ Always remember that what remains is Shillings and Pence, and you muſt alſo divide ſuch

Shillings by the ſame Figure, and you have the true Anſwer.

d.		*lb.*
1½	⅛	1753 at 1½ *per lb.*
	2|0	21|9 – 1½
		£10–19–1½ *Anſ.**

* This you ſee is juſt double the Sum of 3 Farthings.

d.		*lb.*
1½	⅛	1753 at 1¾
¼	⅙	219 – 1½ 36 – 6¼*
	2|0	25|5 – 7¾
		£12-15-7¾

* *Note*, Here I ſay 3 Half-pence is the ⅛th (as before) then I ſay, 1 Farthing is the ⅙th of 3 Halfpence, and dividing by 6, I have 36, and 3 remains, which 3 I call 3 Shillings; then I ſay, the 6th Part of 3 Shillings is 6 Pence, and the 6th Part of 1½ is ¼. Thus you ſee I take the Parts of the Remainder as well as the Parts of the Whole.

Pray obſerve, *Tyro*, and look well at the Example; for I ſhall now leave you to yourſelf for a while.

		Yards
2*d*	⅙	1753 at 2*d.* *per* Yd.
	2|0	29|2 – 2*d.*
		£14–12–2 *Anſ.*

		lb.
2*d*	⅙	1753 at 2¼
¼	⅛	292 – 2*d.* 36 – 6¼
	2|0	32|8 – 8¼
		£16–8–8¼ *Anſ.*

		oz. *d.*
2*d*	⅙	1753 at 2 ½
½	¼	292 – 2*d.* 73 – 0½
	2|0	36|5 – 2½
		£18–5–2½

Ells
2*d* 1/6 1753 at 2*d*. ¾
½ ¼ 292 - 2*d*.
¼ ½ 73 - 0½
36 - 6¼
2|0 40|1 - 8¾
£20-1-8¾ *Anſ.*

lb.
3*d* ¼ 1753 at 3*d*.
2|0 43|8 - 3
£21-18-3 *Anſ.*

lb.
3*d* ¼ 1753 at 3*d*. ¼
¼ 1/12 438 - 3
36 - 6¼
2|0 47|4 - 9¼
£23-14-9¼ *Anſ.*

lb. *d.*
3*d* ¼ 1753 at 3 ½ *lb.*
½ 1/6 438 - 3*d*.
73 - 0½
2|0 51|1 - 3½
£25-11-3½

lb. *d.*
3*d* ¼ 1753 at 3 ¾ *lb.*
¾ ¼ 438 - 3*d*.
109 - 6¾
2|0 53|7 - 9¾
£26-17-9¾ *Anſ.*

Dozen.
4*d* 1/3 1753 at 4*d*.
2|0 58|4 - 4
£29-4-4 *Anſ.*

lb. *d.*
3*d* ¼ 1753 at 4¼ *lb*
1*d* 1/3 438 - 3
¼ ¼ 146 - 1
36 - 6¼
2|0 62|0 - 10¼
£31-0-10¼ *Anſ.*

lb. *d.*
4*d* 1/3 1753 at 4½ *lb.*
½ 1/8 584 - 4
73 - 0½
2|0 65|7 - 4½
£32-17-4½

4*d*	$\frac{1}{3}$	1753 *lb.* at 4*d.* $\frac{3}{4}$ *lb.*
$\frac{1}{2}$	$\frac{1}{8}$	584 – 4*d.*
$\frac{1}{4}$	$\frac{1}{2}$	73 – 0$\frac{1}{2}$
		36 – 6$\frac{1}{4}$
	2|0	69|3 – 10$\frac{3}{4}$
		£34–13–10$\frac{3}{4}$

4*d*	$\frac{1}{3}$	1753 *lb.* at 5*d.* *lb.*
1*d*	$\frac{1}{4}$	584 – 4
		146 – 1
	2|0	73|0 – 5
		£36–10–5 *Anſ*

		Ells
4*d*	$\frac{1}{3}$	1753 at 5*d.* $\frac{1}{4}$
1*d*	$\frac{1}{4}$	584 – 4
$\frac{1}{4}$	$\frac{1}{4}$	146 – 1
		36 – 6$\frac{1}{4}$
	2|0	76|6 – 11$\frac{1}{4}$
		£38–6–11$\frac{1}{4}$ *Anſ.*

4*d*	$\frac{1}{3}$	1753 *lb.* at 5*d.* $\frac{1}{2}$ *lb.*
1*d*	$\frac{1}{4}$	584 – 4
$\frac{1}{2}$	$\frac{1}{2}$	146 – 1
		73 – 0$\frac{1}{2}$
	2|0	80|3 – 5$\frac{1}{2}$
		£40–3–5$\frac{1}{2}$ *Anſ* *

* Or you may take the Parts thus, *viz.* 4*d.* is $\frac{1}{3}$ of a Shilling, as before.

Or thus,

4*d*	$\frac{1}{3}$	1753 *lb.* at 5*d.* $\frac{1}{2}$ *lb.*
1$\frac{1}{2}$	*$\frac{1}{8}$	584 – 4*d.*
		219 – 1$\frac{1}{2}$
	2|0	80|3 – 5$\frac{1}{2}$
		£40 – 5$\frac{1}{2}$ *Anſ.*

* Here I ſay, 1$\frac{1}{2}$ is $\frac{1}{8}$ of a Shilling, and take it out of 1753, the Top-line, which anſwers the ſame End as the laſt Work

		lb. *d.*
4*d*	$\frac{1}{3}$	1753 at 5 $\frac{3}{4}$
1$\frac{1}{2}$	$\frac{1}{8}$	584 – 4*d.*
$\frac{1}{4}$	$\frac{1}{6}$	219 – 1$\frac{1}{2}$
		36 – 6$\frac{1}{4}$
	2|0	83|9 – 11$\frac{3}{4}$
		£41–19–11$\frac{3}{4}$ *Anſ.*

6*d*	$\frac{1}{2}$	1753 *lb.* at 6*d.* *lb.*
	2|0	87|6 – 6
		£43–16–6 *Anſ.*

Yards

		Yards
3*d*	¼	1753 at 6*d.* ¼ *Yd.*
d.		
3*	¼	438 – 3
¼	$\frac{1}{12}$	438 – 3
		36 – 6¼
	2|0	91|3 – 0¼
		£45–13–0¼ *Anſ.*

* Here I ſay 3 Pence is the ¼ of a Shilling in the ſecond Line as well as in the firſt, becauſe then ¼ will be the $\frac{1}{12}$; whereas, if I was to ſay 6*d.* is the ½ of a Shilling, then I muſt ſay ¼ is the $\frac{1}{24}$ of 6 Pence: Now 24 is not ſo eaſy to divide by as 12 is; ſo by bringing Sixpence into 2 Parts, the Work is a great deal more eaſy and natural.

		Buſhels *d.*
6*d*	½	1753 6½ *Buſhel*
½	$\frac{1}{12}$	876 – 6
		73 – 0½
	2|0	94|9 – 6½
		£47 – 9 – 6½ *Anſ.*

		oz.
6*d*	½	1753 at 6¾ *oz.*
¾	⅛	876 – 6
		109 – 6¾
	2|0	98|6 – 0¾
		£49 – 6 – 0¾ *Anſ.*

		lb. *d.*
6*d*	½	1753 at 7 *lb.*
1*d*	⅙	876 – 6*d.*
		146 – 1*d.*
	2|0	102|2 – 7
		£51 – 2 – 7 *Anſ.*

		Gallons
6*d*	½	1753 at 7¼ *Gall.*
1*d*	⅙	876 – 6*d.*
¼	¼	146 – 1
		36 – 6¼
	2|0	105|9 – 1¼
		£52–19–1¼ *Anſ.*

6*d*	½	1753 *lb.* at 7½ *lb.*
1½	¼	876 – 6
		219 – 1½
	2|0	109|5 – 7½
		£54–15–7½ *Anſ.*

4*d*	$\frac{1}{3}$	1753 *Ells* at 7$\frac{3}{4}$
3*d*	$\frac{1}{4}$	584 - 4
$\frac{3}{4}$	$\frac{1}{4}$	438 - 3
		109 - 6$\frac{3}{4}$
	2|0	113|2 - 1$\frac{3}{4}$
		£56-12-1$\frac{3}{4}$ *Anſ.*

Or you may ſay 6*d.* is $\frac{1}{2}$, 1*d.* is $\frac{1}{6}$, and $\frac{3}{4}$ is the $\frac{1}{8}$ of 6 Pence.

4*d*	$\frac{1}{3}$	1753 *Yards* at 8*d.*
4*d*	$\frac{1}{3}$	584 - 4
		584 - 4
	2|0	116|8 - 8
		£58-8-8 *Anſ.*

Or you may ſay 6*d.* is $\frac{1}{2}$, and 2*d.* is $\frac{1}{3}$ of 6 Pence; or as 8*d.* is $\frac{2}{3}$ of a Shilling, you may multiply by 3, and divide by 2.

6*d*	$\frac{1}{2}$	1753 *lb.* at 8$\frac{1}{4}$
2*d*	$\frac{1}{3}$	876 - 6
$\frac{1}{4}$	$\frac{1}{8}$	292 - 2
		36 - 6$\frac{1}{4}$
	2|0	120|5 - 2$\frac{1}{4}$
		£60-5-2$\frac{1}{4}$

4*d*	$\frac{1}{3}$	1753 *Pair* at 8$\frac{1}{2}$
4*d*	$\frac{1}{3}$	584 - 4
$\frac{1}{2}$	$\frac{1}{8}$	584 - 4
		73 - 0$\frac{1}{2}$
	2|0	124|1 - 8$\frac{1}{2}$
		£62-1-8$\frac{1}{2}$ *Anſ.*

4*d*	$\frac{1}{3}$	1753 *Ells* at 8$\frac{3}{4}$
4*d*	$\frac{1}{3}$	584 - 4
$\frac{1}{2}$	$\frac{1}{8}$	584 - 4
$\frac{1}{4}$	$\frac{1}{2}$	73 - 0$\frac{1}{2}$
		36 - 6$\frac{1}{4}$
	2|0	127|8 - 2$\frac{3}{4}$
		£63-18-2$\frac{3}{4}$ *Anſ.*

6*d*	$\frac{1}{2}$	1753 *lb.* at 9*d.*
3*d*	$\frac{1}{2}$	876 - 6
		438 - 3
	2|0	131|4 - 9
		£65-14-9 *Anſ.*

6*d*	$\frac{1}{2}$	1753 *Yards* at 9$\frac{1}{4}$.
3*d*	$\frac{1}{2}$	876 - 6
$\frac{1}{4}$	$\frac{1}{12}$	438 - 3
		36 - 6$\frac{1}{4}$
	2|0	135|1 - 3$\frac{1}{4}$
		£67-11-3$\frac{1}{4}$ *Anſ.*

Ells

6*d*	½	1753 *Ells* at 9½
3*d*	½	876 – 6
½	1/6	438 – 3
		73 – 0½
	2|0	138|7 – 9½
		£69–7–9½ *Anſ.*

6*d*	½	1753 *lb.* at 9¾
3*d*	½	876 – 6
¾	¼	438 – 3
		109 – 6¾
	2|0	142|4 – 3¾
		£71–4–3¾ *Anſ.*

6*d*	½	1753 *Ells* at 10*d.*
4*d*	⅓	876 – 6
		584 – 4
	2|0	146|0 – 10
		£73–0–10 *Anſ.*

6*d*	½	1753 *oz.* at 10¼
3*d*	½	876 – 6
1*d*	⅓	438 – 3
¼	¼	146 – 1
		36 – 6¼
	2|0	149|7 – 4¼
		£74–17–4¼ *Anſ.*

6*d*	½	1753 *lb.* at 10½
3*d*	½	876 – 6
1½	½	438 – 3
		219 – 1½
	2|0	153|3 – 10½
		£76–13–10½ *Anſ.*

6*d*	½	1753 *oz.* at 10¾
3*d*	½	876 – 6
1½	½	438 – 3
¼	1/6	219 – 1½
		36 – 6¼
	2|0	157|0 – 4¾
		£78–10–4¾ *Anſ.*

6*d*	½	1753 *oz.* at 11*d.*
4*d*	⅓	876 – 6
1*d*	¼	584 – 4
		146 – 1
	2|0	160|6 – 11
		£80–6–11 *Anſ.*

6*d*	½	1753 *Ells* at 11¼
4*d*	⅓	876 – 6
1*d*	¼	584 – 4
¼	¼	146 – 1
		36 – 6¼
	2|0	164|3 – 5¼
		£82–3–5¼ *Anſ.*

6*d*	½	1753 *lb.* at 11½
4*d*	⅓	876 – 6
1½	¼	584 – 4
		219 – 1½
	2|0	167|9 – 11½
		£83–19–11½ *Anſ.*
		lb.
6*d*	½	1753 at 11¾
4*d*	⅓	876 – 6
1½	¼	584 – 4
¼	⅙	219 – 1½
		36 – 6¼
	2|0	171|6 – 5¾
		£85–16–5¾ *Anſ.*
		lb.
1*s*	2|0	175|3 at 12 *d.*
		£87–13 *Anſ.*

And thus, *Tyro*, I have ſhewn you from one Farthing to a Shilling, how to take the Parts, ſo as to do any Sum for any Number of *lbs. Yards*, &c. You may by your own Practice take the Parts in what Manner you pleaſe, only remember this *ſtanding Rule*, That when you take the Parts of a Shilling, you muſt divide the Top Number by ſuch Parts; but when you take the Parts of any Part, you muſt divide ſuch a Part by the Number of Parts, and not the Top-line. Do you underſtand it?

Tyro. I do, Sir, very well; but pray, ſuppoſe the Price exceeds one Shilling, how muſt I do then?

Philo. That you will ſoon learn by the following CASE.

CASE

CASE 3.

When the given Price exceeds one Shilling, or 12 Pence, but is leſs than two Shillings, then let the top Line, or given Number, ſtand as it is given, without drawing any Line under it; for that is the Price or Value at one Shilling; then take the Parts, as before, out of the top Line, or given Number, and add the ſaid Parts and top Number together, you have the Anſwer in Shillings, Pence, and Farthings, which divide by 20, as before.

EXAMPLES *above Twelve Pence, and under Two Shillings.*

3*d* | $\frac{1}{2}$ | 1753 *lb.* at 15*d.*
438 – 3*d.*

|0 | 219|1 – 3

£109-11-3 *Anſ.*

Here you ſee that I let 1753 ſtand without drawing a Line, and that is of itſelf an Anſwer for 12*d.* a *lb.* Then I ſay, as before, 3*d.* is $\frac{1}{4}$, and I add theſe two together, muſt be the Price at 15*d.* for 12 and 3 is 15.

6*d* | $\frac{1}{2}$ | 1753 *Ells* at 19*d.* $\frac{1}{2}$
1 $\frac{1}{2}$ | $\frac{1}{4}$ | 876 – 6*d.*
219 – 1$\frac{1}{2}$

2|0 | 284|8 – 7$\frac{1}{2}$

£142-8-7$\frac{1}{2}$ *Anſ.*

EXAMPLES *of other Numbers.*

6*d* | $\frac{1}{2}$ | 47 *Yards* at 21*d.* $\frac{1}{2}$
3*d* | $\frac{1}{2}$ | 23 – 6*d.*
$\frac{1}{2}$ | $\frac{1}{6}$ | 11 – 9
1 – 11$\frac{1}{2}$

2|0 | 8|4 – 2$\frac{1}{2}$

£4-4-2$\frac{1}{2}$ *Anſ.*

6*d*	½	*85 *Ells* at 22*d.* ½
3*d*	½	42 – 6
1½	½	21 – 3
		10 – 7½
	2|0	15|9 – 4½
		£7–19–4½ *Anſ.*

* There is a Sort of *mechanical* Method of doing Sums, or caſting up the Total of the Price of any Commodity, which is often uſed in Buſineſs by ſuch as are not acquainted with taking the Parts according to the ſtrict Order of this Rule.

A mechanical or cuſtomary Way of caſting up any of the foregoing Examples for thoſe that cannot divide by the Parts.

Let us take the laſt *Exanple, viz.* 85 *Ells* at 22*d.* ½ *per* Ell.

Rule. Count how many Shillings, 6 Pences, Groats, Pence, or any other Denomination the given Number makes, and ſet the Products under one another, as in *Addition*, and add all together, you have the Anſwer.

Thus the laſt *Example* 85 *Ells* at 22*d.* ½ *per* Ell.

Firſt,	85 Shillings	£4 – 5 –
	85 Six-pences	2 – 2 – 6
	85 Three-Pences } is	1 – 1 – 3
	85 Pence	– 7 – 1
	85 Half-pence	– 3 – 6½
		£7 – 19 – 4½ as before

Tyro. I heartily thank you, Sir, for theſe Obſervations.

Philo. I do it to ſerve you, take which Way you pleaſe; for that is beſt which is ſooneſt underſtood, tho' it be a little deviating from the ſtated Rule itſelf. And now, *Tyro*, we will proceed to the other Part of this Rule.

CASE 4.

Rule 1. When the given Price is above two Shillings, then (by *Table* 2) take ſuch Shillings as even Parts of a £. and divide the given Quantity thereby; then take the Pence as Parts of a Shilling, and the Farthings as Parts of a Penny, dividing each Sum or Line by the Parts to which they belong. Or,

Rule 2. Multiply the given Quantity by the Shillings, and then take the Parts for the Pence and Farthings, as in the laſt Caſes; then add all together, and divide by 20, it is done.

		Yards
2*s*	$\frac{1}{10}$	125 at 2*s*. 8*d*. ½ *Yd*.
6*d*	¼	12 – 10*s*.
2*d*	⅓	3 – 2 – 6*d*
½	¼	1 – 0 – 10
		– 5 – 2½
		£16 – 18 – 6½ *Anſ*.

Here 2*s*. is $\frac{1}{10}$ of a £. therefore I divide 125 by 10, and it gives £12-10*s*. the Price at 2*s*. *per* Yard. Then 6*d*. is ¼th of 2*s*. I therefore divide £12-10*s*. by 4, and it gives £3-2-6. Then 2*d*. is ⅓ of 6*d*. I therefore divide £3-2-6 by 3, and it gives £1 and 10 Pence, the Price at 2*d*. *per* Yard. *Laſtly*, I ſay ½ny is ¼ of 2*d*. and take the ¼ of £1 – 10*d*. Pence is 5*s*. 2*d*. ½ the Price at ½ny a Yard. The Sum of all theſe is £16-18-6½. *Anſ*.

PROOF *by the Second* RULE.

		Yards
d.		125 at 2*s.* 8*d.* ½
6*	½	2
		250
		62 – 6*d.*
2*d*	⅓	20 – 10
½	¼	5 – 2½
		33|8 – 6½
		£16–18–6½ as before

* Here I multiply 125 by 2, and it gives 250 Shillings, at 2*s.* a Yard. Then I ſay 6*d.* is ½ of a Shilling, therefore, I divide the top Line 125 by 2, (and not 250) and it gives 62*s.* 6*d.* and ſo for any other Sum; then I take the other Parts, as before directed, as by the Work appears.

Philo. Do you underſtand it?

Tyro. I do very well; but I like the laſt Way the beſt.

Philo. Take which you pleaſe, 'tis only Uſe that makes both eaſy.

		Ells
5*s*	¼	417 at 5*s.* 10*d.*
d.		
10	⅙	104 – 5*s.*
		17 – 7 – 6*d.*
		£121 – 12 – 6 *Anſ.*

Firſt, 5*s.* is ¼ of a £. I divide 417 by 4, gives £104 - 5*s.* then 10 Pence is ⅙ of 5*s.* therefore I divide £104 - 5*s.* by 6, and find the Quotient £17, and 2 over, this 2 I call 2 Pounds, and the odd 5*s.* makes £2 – 5, or 45 Shillings; then I ſay the 6's in 45 is 7 Times, and 3 over; this I call 3 Shillings, and divide that alſo by 6, it gives 6 Pence.

PROOF.

4*d*	⅓	417 *Ells* at 5*s*. 10*d*.
		5
4*d*	⅓	2085
		139
2*d*	½	139
		69 – 6*d*.
	2|0	243|2 – 6
		£121-12-6 as before

Here I multiply by 5, and it makes Shillings; then I ſay 4 Pence is ⅓ of a Shilling, and take it out of the top Line 417: I ſay again 4 Pence is ⅓, and ſet down the ſame; then 2 Pence is ½ of 4 Pence, and having added all up, and divided by 20, I have the ſame Anſwer.

And now, *Tyro*, I ſhall ſet you a few Examples with Words at Length.

10*s*	½	57 Pieces at 12*s* 9*d* ½
s. *d*.		
2-6	¼	28 – 10 –
3*d*	1/10	7 – 2 – 6
½	⅙	– 14 – 3
		– 2 – 4½
		£36 – 9 – 1½ *Anſ*

10*s*	½	185 Load at 18*s* 10*d*
4*s*	⅕	92 – 10
4*s*	⅕	37 –
"	⅙	37 –
2*d*	¼	6 – 3 – 4*d*.
		1 – 10 – 10
		£174 – 4 – 2 *Anſ*.

PROOF.

6*d*	½	57 Pieces at 12*s* 9*d* ½
		12
		684
3*d*	¼	28 – 6
½	⅙	14 – 3
		2 – 4½
	2|0	72|9 – 1½
		£36-9-1½ as before

PROOF.

6.	½	185 Load at 18*s* 10*d*
		18 multiply
4*d*	⅓	3330
		92 – 6
		61 – 8
	2|0	348|4 – 2
		£174-4-2 as above

And thus, *Tyro*, you may take which Method you pleaſe; but in the next *Caſe* you are confined to take the Parts according to *Table* 2.

CASE 5.

When the given Price of any Thing is more than 20 Shillings, or 1 Pound, and not ſo much as 2 Pounds, then let the given Quantity ſtand without drawing a Line under it, and that is the Price, at 1 Pound; then take the Parts for the Shillings and Pence, as in the laſt *Caſe*, and the Work is done.

EXAMPLES.

		Ells
10*s.*	$\frac{1}{2}$	45 at £1-12-6
2*s* 6*d*	$\frac{1}{4}$	22 - 10
		5 - 12 - 6
		£73 - 2 - 6 *Anſ.*

Here I let 45 ſtand without drawing any Line under it, which is the Price at 1 Pound *per* Ell; then I take the Parts according to the Rule in the laſt *Caſe*, adding all together have £73 - 2 - 6 *Anſ.*

		Tons
10*s.*	$\frac{1}{2}$	75 at £1-17-11½
5	$\frac{1}{2}$	37 - 10
2*s* 6*d*	$\frac{1}{2}$	18 - 15
5*d*	$\frac{1}{6}$	9 - 7 - 6
½	$\frac{1}{10}$	1 - 11 - 3
		- 3 - 1½
		£142-6-10½ *Anſ.*

Here you ſee 75 Tons at £1 *per* Ton is £75, which I let ſtand without drawing any Line under it, and then I take the Parts for 17*s.* 11*d.* ½, as you find in the Margin.

CASE 6.

When the given Price of the Commodity is above two Pounds, then multiply by the Pounds gives the Anſwer, for the Number of Pounds, and the Shillings and Pence and Farthings muſt be taken out of the Top, or given Number, as before directed.

EXAMPLE.

10*s*	$\frac{1}{2}$	37 *Load* at £3-16-9
		3
		111
5*s*	$\frac{1}{2}$	18 – 10 –
1*s*	$\frac{1}{5}$	9 – 5 –
6*d*	$\frac{1}{2}$	1 – 17 –
3*d*	$\frac{1}{2}$	– 18 – 6
		– 9 – 3
		£141 – 19 – 9 *Anſ.*

Here I multiply 37 by £3, which gives £111, and then I ſay, 10*s*. is $\frac{1}{2}$ of a £. and take it out of the Top £37, which is £18 – 10*s*. then I ſay 5 Shillings is $\frac{1}{2}$ of 10, and take the $\frac{1}{2}$ of £18-10*s* which is £9 - 5*s*. and ſo I go on, taking the Parts as the Work plainly ſhews.

One EXAMPLE *at large.*

		Hhds.
10*s*	$\frac{1}{2}$	15 at £12–18 & $\frac{3}{4}$
		12
		180
5*s*	$\frac{1}{2}$	7 – 10
2-6	$\frac{1}{2}$	3 – 15
6*d*	$\frac{1}{5}$	1 – 17 – 6
$\frac{3}{4}$	$\frac{1}{8}$	– 7 – 6
		– – 11 $\frac{1}{4}$
		£193–10–11$\frac{1}{4}$ *Anſ.*

Here 15 Hhds. at £12 *per* Hhd. is £180; then I ſay 10*s*. is $\frac{1}{2}$, and take the $\frac{1}{2}$ of £15, the top-Number, which is £7-10*s*. and ſo I proceed, by taking the reſt of the Parts, ſaying, 5 Shillings is the $\frac{1}{2}$ of 10 Shillings, and take the $\frac{1}{2}$ of £7 – 10*s*. &*c*.

And now, *Tyro*, I think you have had ſufficient Inſtructions in this Rule, if you carefully obſerve them. However, that I may omit Nothing that may be uſeful to you in Buſineſs, there are ſome ſhorter Methods of caſting up Things than the Rule itſelf teaches; but this is according to the given Price, that is, when the given Price is juſt two Shillings, or when it is any even Number of Shillings, as in the two following *Caſes*,

CASE 7.

When the given Price is any even Number of Shillings, as 2, 4, 8, 14, 16, *&c.* Then multiply the given Quantity by half the even Number of Shillings, and cut off the firſt Figure in the Units Place with a Daſh of your Pen, or Pencil; then all the Figures to the Left-hand are Pounds, and the Figure you cut off in the Units Place being doubled, will be Shillings, and you have the Anſwer required.

EXAMPLES.

48 Yards at 4*s.* *per* Yard.
2
———
£9|6
Anſ. £9-12*s*

Here the Price is 4 Shillings *per* Yard, therefore I multiply the given Quantity 48 by Half the Price, (*viz.* 2) and it is 96; then I cut off the firſt Figure (*viz.* 6) and double it, which is 12 for the Shillings, and the Figure 9 is the Pounds; ſo is the Anſwer £9 – 12*s.* Again,

328 Ells at 12*s.* *per* Ell.
6
———
£196|8
Anſ. £196–16*s.*

Here I multiply by 6, which is ½ the given Price, and cut off the firſt Figure, and double it for the Shillings, which is 16, and the Figures on the Left-hand of the Daſh are Pounds.

More EXAMPLES.

417 at 14*s*. Again, 695 Ells at 18*s*.
7 9

£291|9 *Anſ.* £291–18*s*. £625|5 *Anſ.* 625–10*s*.

CASE 8.

When the given Price is any even Number of Shillings, and you would know what Quantity of any Thing may be bought for any even Number of Pounds Sterling, then only add a Cypher to the given Pounds, and divide that Sum by Half the Number of the given Price, gives the Anſwer in Pounds Sterling.

EXAMELES.

How many *lb.* of Tea, at 12*s*. *per lb.* may I have for £36. *Anſ.* 60 *lb.*

£36 add a Cypher is 360

$\frac{1}{2}$ of 12*s*. is 6) 60 *lb.* *Anſ.*

How many Gallons of Rum, at 18*s*. *per* Gallon, may I have for £250.

£250 add a Cypher is 2500

$\frac{1}{2}$ of 8*s*. is 4) 625 Gallons. *Anſ.*

Tyro. I like this very well, Sir; and it is not only eaſier, but much ſhorter than taking the Parts: But ſuppoſe there be Fractions after the given Number, how then?

Philo. Take ſuch *Fractional* Parts out of the given Price and add it to the reſt of the Work, as by the following *Caſe*.

CASE

CASE 9.

When the given Quantity, or Number, has *Fractional* Parts after it, then take ſuch Parts out of the given Price, and place the Sum under the reſt, and add all together. Or thus, (which may be eaſier) Multiply the Price by the *Numerator*, (or Top-figure) of the Fraction, and divide the Product by the Denomination (or Lower-figure) and you have the *Fractional* Value at once.

```
10s. | 1/2 | 15 5/8 Yards at 10s.
           ---------------
     | 5/8 |  7 - 10
                 6 - 3  for 5/8ths
           ---------------
           | £7 - 16 - 3   Anſ.
```

Here I ſay $\frac{1}{8}$th of 10s. is 1s. 3d. therefore, $\frac{5}{8}$ths is 5 Times as much, *viz.* 6s. 3d. Or thus, I multiply 10s. the Price, by 5, the Numerator, which is 50, and divide by 8, the Denominator, I have 6s. 3d. the Price at $\frac{5}{8}$ths.

```
    | 3 7/8 Yards at 18s.
    | 9*
    ------------------
    | 2 - 14 -
7/8 |      15 - 9
    ------------------
    | £3 - 9 - 9  Anſ.
```

* Here the Price being an even Number of Shillings, I multiply by $\frac{1}{2}$ of it, *viz.* 9, (according to the Rule in the laſt *Caſe*) and double the firſt Figure, which is £2 - 14s. Then for $\frac{7}{8}$ I multiply the Price, *viz.* 18s. by 7, and divide by 8, and it is 15s. 9d. And thus may many Sums in this *Caſe*, as well as in others, be done in a very ſhort and eaſy Manner, by Care and Obſervation.

Tyro. I ſee it plainly, Sir; and now, if you pleaſe, I would be glad to have a Notion of working *Weight*, *viz.* *Tons*, *Cwts.* *qrs.* *lbs.* &c.

Philo. I am as ready to inſtruct you.

SEC-

SECTION II.

Of WEIGHT.

Tyro. WHAT is the Nature of working this Rule?

Philo. By taking the Parts, as before directed; as you will plainly ſee by and by: But firſt of all the two following Tables ought to be learned perfectly.

TABLE 1.

Even Parts of a Ton.

C.	*qrs.*		
10	0	is	$\frac{1}{2}$ a *Ton.*
5	0		$\frac{1}{4}$
4	0		$\frac{1}{5}$
2	2		$\frac{1}{8}$
2	0		$\frac{1}{10}$
1	1		$\frac{1}{16}$
1	0		$\frac{1}{20}$

TABLE 2.

Even Parts of an Cwt.

qrs.	*lbs.*		
2	0	is	$\frac{1}{2}$ an *Cwt.*
1	0		$\frac{1}{4}$
	16		$\frac{1}{7}$
	14		$\frac{1}{8}$
	8		$\frac{1}{14}$
	7		$\frac{1}{16}$

Having got the above *Tables* pretty readily by Heart, the Rule is,

RULE.

Multiply the given Tons, or Hundreds, by the given Price, and if there be any Parts, as Shillings and Pence, work with them as in the foregoing Examples: This being done, take the Parts for the odd Weight out of the given Price, and place it under the reſt, and the Work is done.

But this is better underſtood by an Example or two.

What comes 7 *C.* 3 *qrs.* to, at £2 – 6*s.* *per Cwt.*

		2
5*s.*	$\frac{1}{4}$	14
1	$\frac{1}{5}$	1 – 15
2 *qrs.*	$\frac{1}{2}$	– 7
1	$\frac{1}{2}$	1 – 3
		– 11 – 6
		£17 – 16 – 6

Here I multiply 7 by 2, and it gives £14; then I ſay 5*s.* is $\frac{1}{4}$, and take the $\frac{1}{4}$ of £7, the top Number, then I ſay 1*s.* is $\frac{1}{5}$ of 5*s.* and take the $\frac{1}{5}$ of £1 – 15*s.* This being done, I begin with the odd Weight, ſaying, 2 *qrs.* is $\frac{1}{2}$ of an *Cwt.* and I take the $\frac{1}{2}$ of the Price £2-6*s.* and it is £1-3*s.* then 1 *qr.* is $\frac{1}{2}$ of 2 *qrs.* I take the $\frac{1}{2}$ of £1 – 3*s.* which is 11*s.* 6*d.*

What coſt 14 *Ton,* 6 *C.* 3 *qrs.* 14*lb.* at £12–10 *per Ton?*

		12	
10*s.*	$\frac{1}{2}$	168	— The Value at £12 *per Ton.*
5*C.*	$\frac{1}{4}$	7 – –	— Ditto at 10*s.* *per Ton.*
1*C.*	$\frac{1}{5}$	3 – 2 – 6	— The $\frac{1}{4}$ of £12-10*s.*
2 *qrs.*	$\frac{1}{2}$	– 12 – 6	— The Price of 1 *C.*
1 *qr.*	$\frac{1}{2}$	– 6 – 3	— Ditto of 2 *qrs.*
14*lb.*	$\frac{1}{2}$	– 3 – 1$\frac{1}{2}$	— Ditto of 1*qr.*
		– 1 – 6$\frac{3}{4}$	— Ditto of 14*lb.*
		£179 – 5 - 11$\frac{1}{4}$ *Anſ.*	

I have here, *Tyro,* ſet againſt every Line what the Value is, and where it is taken out of, that you may be the better grounded in the Work: For remember the Money is taken out of the given Weight, and the odd Weight is taken out of the given Price, as you were told in the Rule.

Tyro. I ſee the Nature of it, Sir, plainly.

Philo. Then I ſhall leave you a few Queſtions for you to work, or prove at Leiſure.

QUESTIONS *to exerciſe the Learner.*

1. What coſt 125 *lb.* of Indigo, at 14*d.* ¾ *per lb?* *Anſ.* £7 – 13 – 7¾.

2. What is gained in £476, at 4*s.* 10*d.* ½ *per* £. *Anſ.* £116 and 6*d.*

3. What is the Value of 47 Load, at £3 – 15 – 6½ *per* Load? *Anſ.* £177 – 10 – 5½.

4. What coſt 9 Ton, 15 *C.* 3 *qrs.* 27 *lb.* of Iron, at £14 *per* Ton? *Anſ.* £137 – 3 – 10½.

DIALOGUE X.

SECTION I.

SIMPLE INTEREST.

Tyro. SIR, you have given me great Satisfaction in the Rules of *Practice*, and now I ſhould be glad to be informed ſomething concerning *Intereſt*. Pray what is it?

Philo. *Intereſt* is Money that ariſes from a certain Sum lent out at ſo much *per Cent. per Annum*; and is a Conſideration allowed by the Borrower to the Lender.

Tyro. What do you mean by *per Cent. per Annum?*

Philo. *Per Cent.* ſignifies 100 Pounds, and *per Annum* ſignifies a Year, or 12 Calendar Months.

Tyra. How is the Intereſt found?

Philo. *Intereſt* may be performed by the *Rule of Three Direct*, (as you may ſee by *Example* 1 following) but in ſome Caſes it is done eaſier and ſhorter by *Practice* and Cuſtom, and that is the Reaſon that *Intereſt* has a Place and Title in all Books of Arithmetic by itſelf.

Tyro. Pleaſe to give an Example by the *Rule of Three*, and prove it by the ſhort cuſtomary Way.

Philo. I will.

EXAMPLE.

What is the Intereſt of £175 – 10*s.* for a Year, at £5 *per Cent. per Annum.*

£. £. £. *s.*
If 100——be 5—— what is 175 – 10
20 20
2000 3510
5
2000)17550(8£.
16000
1550
[illegible]0
2000)31000(15 Shillings
2000
11000 *Anſ.* £8 – 15 – 6.
10000
1000
12
2000)12000(6*d.*
12000
0

Here you ſee I am obliged to make my *firſt* and *ſecond* Number of one Name, ſo that according as the Sum is, it requires a great many Figures; but by the other Method you ſpare all this Trouble; which pray obſerve.

Second

Second METHOD. CASE I.

Multiply the Principal, or given Sum, by the Rate *per Cent.* and cut off two Figures towards the Right-hand, (which is the ſame, obſerve, as dividing by 100) and the Figures towards the Left are Pounds Intereſt: This done, multiply the Figures cut off to the Right-hand by 20, and take in the odd Shillings, and cut off two Figures, as before, and the Figures on the Left-hand are Shillings: Then multiply the Remainder by 12, and cut off two Figures, and the Figures on the Left-hand are Pence. *Laſtly*, multiply by 4, and cut off as before, you have the Farthings,

Thus the above Example is done, as under.

£. s.
175 - 10
5

£8)77 - 10
20

*s.*15) 50
12

*d.*6) 00 *Anſ.* £8 - 15 - 6 as above

Tyro. Indeed this is very ſhort, to what the firſt Work is.

Philo. Then pray obſerve the Rule; for all the following Examples are performed after the ſame Manner; and remember, that cutting off two Figures towards the Right-hand is the ſame as dividing by 100.

Queſt. 2. What is the Intereſt of £515 - 10*s.* for 1 Year, at £4 *per Cent. per Annum.*

£515 - 10
4 *per Cent.* Multiply

£20)62
20

*s.*12) 40
12

*d.*4) 80
4

qrs. 3) 20

Anſ. £8 - 12 - 4¾ $\frac{20}{100}$, or $\frac{2}{10}$ths of a Farthing.

Queſt. 3. What is the Intereſt of £1050 for 1 Year, at £3 *per Cent. per Annum?*

£1050
3 *per Cent.*

£31)50
20

*s.*10) 00 *Anſ.* £31 - 10*s.*

Tyro. You need not give me any more Examples of this Sort: But ſuppoſe the Money be lent for more than one Year, how then?

CASE 2.

When the given Rate *per Cent.* is an even Part of £100, then divide the Principal by that even Part, and the Quotient is the Anſwer at once.

Take *Example* 1, *viz.* £175 – 10*s.* at £5 *per Cent.*

Here £5 being $\frac{1}{20}$ of £100, I only divide £175–10*s.* by 20, and it is done.

$$\begin{array}{l} \quad\ \text{£.} \qquad s. \\ 2|0)17|5 - 10^{*} \\ \hline \text{£}8 - 15 - 6 \ \textit{Anſ.} \end{array}$$

* *Note*, After I divide 175 by 20, I ſay, the 20th Part of 10*s.* is 6 Pence.

Queſt. 4. What is the Intereſt of £345 – 17 – 6, at £25 *per Cent.*

Here £25 being $\frac{1}{4}$th of £100, I divide the Principal £345 – 17 – 6 by £4, and it is done.

$$\begin{array}{l} \quad\ \text{£.} \qquad s. \qquad d. \\ 4)345 - 17 - 6 \\ \hline \text{£}86 - 9 - 4\tfrac{1}{2} \ \textit{Anſ.} \end{array}$$

CASE 3.

When the Principal is put out for Years and Months, find the Intereſt for the Years firſt, and take the Months as even Parts of a Year, according to the Rules of *Practice.*

Queſt. 5. What is the Intereſt of £175 – 10*s.* for 3 Years 9 Months, at £5 *per Cent. per Annum.*

£175 – 10
5 *per Cent.*

£8) 77 – 10
20

*s.*15) 50
12

*d.*6) 00

Intereſt for 1 Year is £8 – 15 – 6
3

6 Mths. $\frac{1}{2}$ a Year	26 – 6 – 6 for 3 Yr
3 Mths. $\frac{1}{2}$	4 – 7 – 9
	2 – 3 – 10$\frac{1}{2}$

Anſ. £32 – 18 – 1 $\frac{1}{2}$

A Practical QUESTION.

Queſt. 6. A Gentleman left his Niece by Will £558 – 15 Shillings, to be paid her when ſhe came to Age, with Intereſt, at £4 *per Cent*. Now ſhe came to Age in 5 Years, 9 Months, and 3 Weeks: What has ſhe got to receive in all, Principal and Intereſt?

£558 - 15*s*.
4 *per Cent*.

£22)35 Intereſt for 1 Year £22 - 7*s*.
20 5 Years

s.7)00

6 Mths ½ Year | 111 - 15
3 Mths ½ | 11 - 3 - 6*d*.
2 Weeks ⅙ | 5 - 11 - 9
1 Week ½ | - 18 - 7½
| - 9 - 3¾

£129 - 18 - 2¼ Intereſt
558 - 15 - Legacy

The Legacy and Intereſt is £688 - 13 - 2¼

Tyro. Sir, I thank you for theſe two uſeful Examples: And now I would only aſk this one Favour, and that is, how am I to tell the Intereſt of any Sum for any Time, at 3½, 4½, 4¾, or the like *per Cent*.

Philo. It is ſomething more difficult than the other, but an Example or two, with your due Obſervation, will make it very eaſy.

CASE 4.

When the given Rate *per Cent.* is not even Pounds, but is 2½, 3¼, 4½, or the like, then multiply the Principal, or given Sum by the even Pounds, and take the ½, or ¼, or ¾ of the ſaid Principal, or given Sum, and add to that Product; then cut off two Figures, and proceed in all Reſpects as before.

Queſt. 7. What comes the Intereſt of a Bond of £685 to, at £4½ (that is, £4 - 10*s.*) *per Cent. per Annum?*

685
4
s. 10 | ½ | 2740
342 - 10
£30)82 - 10
20
*s.*16)50
12
*d.*6)00

Here I multiply by 4, then for ½ *per Cent.* which is 10 Shillings, I ſay 10*s.* is ½, as in *Practice*, and take ½ of 685, and add to the other, it is £3082 - 10*s.* then I cut off two Figures thus, 30|82 and proceed as before, I find it £30 - 16 - 6.

Queſt. 8. Lent £500 upon a Mortgage, to receive Intereſt at £4 ¾ (*viz.* £4 - 15*s.*) *per Cent.* till it was paid off: Now the Mortgage was paid off 3 Years, 8 Months after: I demand the Intereſt due to me?

		£.			
		500	Intereſt for 1 Year is £23 - 15 -		
		4	Multiply by		3
s.					
10	½	2000	6 Months	½	71 - 5 - for 3 Yrs
5	½	250	2 Months	⅓	11 - 17 - 6 6 Mths
		120			3 - 19 - 2 2 Mths
		£23)75			£87 - 1 - 8 *Anſ.*
		20			
		*s.*15)00			

Tyro. I underſtand all theſe Examples very well; but ſuppoſe the Intereſt be for leſs than a Year, how then am I to find it?

Philo. Very eaſily.

CASE 5.

When the Intereſt of any Sum is to be found for leſs than a Year, *viz.* for 1, 2, 3, 4, or 10 Months, or for Months and odd Days, then firſt find the Intereſt for 1 Year, and take the Parts of that Year's Intereſt according to the given Time: Thus, if it be 6 Months Intereſt, take the Half of the Year's Intereſt; if 9 Months, take ¾; if 3 Months, take ¼; and for the odd Weeks, or Days, take the Parts of thoſe Months.

Queſt. 9. What is the Intereſt of £175 - 10*s.* for 8 Months, at £5 *per Cent. per Annum?*

£.
175 - 10
5
£8)77 - 10
20
*s.*15)50
12
*d.*6)00

Intereſt for 1 Year is £8 - 15 - 6

Then ſay, 6 Mths	½	4 - 7 - 9 for 6 M
2 Mths	⅓	1 - 9 - 3 for 2 M
		£5 - 17 - *Anſ.*

Here you ſee I take the Half of 1 Year's Intereſt, which is £4 - 7 - 9 for 6 Months; then I ſay, 2 Months is ⅓ of 6 Months, and take the ⅓ of £4 - 7 - 9, and add both together, is £5 - 17 for 8 Months.

Tyro. I am ſatisfied, Sir.

Philo. This is the beſt Way for calculating Intereſt in general, and will be near enough for common Practice, ſhould there be Weeks or Days; for it is only taking the Parts for ſuch Weeks and Days, as was ſaid before.

Tyro. But ſuppoſe the Intereſt be put out for ſuch a Number of Days as cannot well be taken in their even Parts, how then?

RULE 1.

Philo. Firſt, Find the Intereſt for one Year, as before; then ſay, If 365 Days give ſo much, what will ſo many Days give? Thus: Suppoſe the Intereſt for one Year be £17 - 10 - 10, and it was required to find the Intereſt for 73 Days, I ſay,

If 365 Days give £17 - 10 - 10, what will 73 Days give? *Anſ.* £3 - 10 - 2.

RULE

RULE 2.

Bring the Principal, or Money lent out, into Pence. and multiply thoſe Pence by the Number of Days the Sum is put out at, or continues out; then if the Rate *per Cent.* it be put out at be £5, divide by 7300; and if it be £6 *per Cent.* divide by 6083, you have the Anſwer in Pence. There are many other Ways to find the Intereſt for Days; but I would recommend the firſt Rule of theſe two to the Learner, as it ſerves for all Rates *per Cent.* and is moſt certain.

SECTION II.

Of Aſſurances, Brokerage, *or* Commiſſion.

Tyro. WHAT is *Aſſurance, Brokerage, or Commiſſion?*

Philo. Aſſurances, or *Inſurances* are of various Sorts. An *Aſſurance* is when any Perſon agrees with another at a certain Rate *per Cent.* to inſure his Life for ſuch a Time, or his Ship upon a Voyage, from the Dangers of the Seas, or his Houſe or Goods from Fire. *Brokerage* is an Allowance of ſo much *per Cent.* given to *Brokers,* or Perſons employed in buying and ſelling Stocks, or tranſacting Buſineſs between Buyer and Seller: And *Commiſſion* is alſo an Allowance of ſo much *per Cent.* for buying or ſelling any Sort of Commodity, by the Order of any other Perſon. *&c.*

Tyro. Then I perceive theſe are all caſt up the ſame as the Intereſt of Money is.

Philo. They are ſo, only Intereſt is ſo much *per Cent. per Annum*; but *Brokerage* is caſt up only at ſo much *per Cent.* ready Money, without any Regard to Time. Of theſe in their Order.

1. *Of* ASSURANCES.

Queſt. 1. What comes an Aſſurance of £580 to, at £10 $\frac{3}{4}$ *per Cent.*

```
              £.
             580
              10
s.          ------
10 | 1/2 |  5800
 5 | 1/2 |   290
             145
            ------
         £62)35
              20
            ------
          s.7)00
```

Here I multiply by 10, then I take the Parts out of the Top, or £580, and add all together, and cut off two Figures, (which is dividing by £100) and proceed as in Intereſt, by multiplying the Remainder by 20, *&c.*

Anſ. £62 – 7*s.*

Queſt. 2. Shipped for *Jamaica* Goods to the Value of £1200, upon which I made an Aſſurance, at £7 $\frac{5}{8}$ths *per Cent.* what does it come to?

```
                    £.
                   1200
                      7
                  ------
4/8 is 1/2 |      8400
1/8 is 1/4 |       600
                   150
                  ------
               £91)50
                    20
                  ------
               s.10)00
```

Here I multiply by 7. then I ſay for the Fraction 4 Eighths is $\frac{1}{2}$, that is, the $\frac{1}{2}$ of $\frac{8}{8}$ths (for 8 Eighths is equal to 1 whole Integer) and take the $\frac{1}{2}$ of the top Number; then I ſay $\frac{1}{8}$th is $\frac{1}{4}$ of $\frac{4}{8}$ths; then I add all together, and cut off two Figures, as before, *&c.* and find the Anſwer £91 – 10*s.*

2. *Of* BROKERAGE *and* COMMISSION.

Tyro. You need not give me any more Examples; for I ſee the Work is the ſame, tho' under different Titles, or Names.

Philo. It is ſo; but ſtill when the *per Cent.* is Shillings it may be a little difficult to you, therefore, I will give you an Example or two.

Queſt. 3. What is the Commiſſion of a *Broker* for buying or ſelling £520 Stock, at Half a Crown *per Cent.*

Rule. Multiply the Money by the Shillings, and take the Parts for the Pence as in *Practice*; then add all together, and cut off two Figures to the Right-hand, and thoſe towards the Left are your Anſwer in Shillings.

£520
2
6*d* | ½ | 1040
260
s. 13)00

Anſ. 13 Shillings.

Queſt. 4. What is my Commiſſion on £1500 at 7*s.* *per Cent.*

7
Shill. 105)00

Anſwer £5 — 5*s.*

Another Way.

Cut off two Figures of the given Sum, and multiply the Remainder by 20, 12, and 4, gives the Anſwer, at £1 *per Cent.* then take the Parts of the Sum of £1 *per Cent.* as in *Practice*, you have your Anſwer.

Queſt. 5. What is my Commiſſion on £1252 – 10*s.* at 7*s.* 6*d.* *per Cent.*

£12)52 – 10*s.*
20
*s.*10)50
12
*d.*6)00

At £1 *per Cent.* it is £12 - 10 - 6
Then, 5*s.* | $\frac{1}{4}$ | 3 - 2 - $7\frac{1}{2}$
2–6 | $\frac{1}{2}$ | 1 - 11 - $3\frac{3}{4}$
Anſ. £4 - 13 - $11\frac{1}{4}$

3. *Compound* INTEREST.

Tyro. What is *Compound Intereſt?*

Philo. *Compound Intereſt* is called Intereſt upon Intereſt; that is, the Intereſt of the Principal, and the Intereſt of the Intereſt added together, is the *Compound* Intereſt. But it being ſeldom uſed without it be in purchaſing of Annuities, *&c.* andbeing very tedious to calculate, is done with more Eaſe by *Decimal Fractions.*

Tyro. But I ſhould be glad you would give me a little better Notion of it.

Philo. Suppoſe I put out £100 for 3 Years, at £5 *per Cent. Compound* Intereſt, what does it come to?

Firſt, I find the Simple Intereſt for 1 Year is £5; then the ſecond Year I am to count what the Intereſt of £105 is, and find it £5 – 5*s.* This I add to the laſt Principal £105, and it makes £110 – 5*s.* Then I ſee what is the Intereſt of £110 – 5*s.* and find it £5 – 10 – 3 for the third Year. Then I add theſe different Intereſts together, *viz.* £5, £5 – 5*s.* and £5 – 10 – 3, and it makes £15 – 15 – 3, the *Compound Intereſt* for three Years on £100, at £5 *per Cent.* And thus for any Number of Years, at any Rate *per Cent.*

SEC-

SECTION III.

Of REBATE, *or* DISCOUNT.

Tyro. WHAT do you mean by *Rebate*, or *Diſcount?*

Philo. *Diſcount* is when a Sum of Money, which is to be paid at any Time to come, is ſatisfied by paying of it down in preſent Money; which preſent Money being put out after the ſame Rate *per Cent.* and for the ſame Time, will be increaſed to the Debt or Sum that was firſt to be paid.

Tyro. Explain this a little fuller in other Words.

Philo. Suppoſe a Perſon owes me 100 Guineas, *viz.* £105 to paid a Year, or 12 Months to come, how much preſent Money will ſatisfy the Debt? *Anſ.* £100 preſent Money will ſatisfy a Debt of £105 due 12 Months hence; becauſe £100 put out to Intereſt 12 Months will be £5.

There are ſeveral Methods of performing this Rule of *Diſcount*; but as it is beſt done by *Decimal Fractions*, I ſhall give only this one general Rule.

A General RULE.

1. Add the Intereſt of £100 for the given Time to £100, and make this your *firſt Number*; then place £100 only for your *ſecond Number*, and the given Debt your *third Number*, and the Anſwer will be the preſent Money that will ſatisfy the Debt due 12 Months to come; then take this preſent Money from the Debt, and the Remainder is the *Rebate* for 12 Months.

2. Having thus found the Rebate for one Year, if the Time be more or leſs than 12 Months, take the Parts by the Rule of *Practice* accordingly.

3. Thus it appears that the *firſt Number* is always known according to the Rate *per Cent.* for one Year, as by the following Table.

For at £3 *per Cent.* the *firſt Number* will be 103, *&c.*

£ 3 *per Cent.*	103
4	104
5	105
6	106
7	107
8	108

Theſe obſerve are *firſt* Numbers according to the *Rebate per Cent.* for one Year, £100 is your *ſecond*, and the Debt your *third*, and the Anſwer is the preſent Money to be paid down.

Queſt. 1. What preſent Money will pay a Draught or Note of Hand of £368 – 4*s.* due 3 Months hence, allowing Rebate at £5 *per Cent. per Annum.*

£.		£.		£.	*s.*
If 105	——	100	——	368 –	4.

Anſ. £350–13–4. which taken out of the Debt £368 - 4*s.* leaves £17 - 10 - 8 the Diſcount for one Year.

1. *Rule.* Bring the *firſt* and *third* Number into Shillings; then multiply the *third* by your *ſecond*, and divide by your *firſt*, you have £350, and 14 remains, which alſo multiply by 20, and divide by your *firſt Number*, you have 13 Shillings, and 7 remains, which multiply by 12, and dividing by the ſame *firſt* Number, you have 4*d.*

Note of Hand		£368 – 4 –	
Preſent Money		350 – 13 – 4	
Diſcount is		17 – 10 – 8	for 1 Year
3 Months	$\frac{1}{4}$	4 – 7 – 8	*Anſ.* for 3 Months.

Here you ſee for one Year the *Diſcount* is £17 - 10 - 8, and as 3 Months is ¼th of a Year, I take the ¼th of that Sum, which is £4 – 7 – 8 *Anſ.*

Note, Had the Note been drawn for 15 Months, that is, 1 Year, and 3 Months; then add £4 – 17 – 8, the *Diſcount* of 3 Months to £17 – 10 – 8, which is £21 – 18 – 4, the *Diſcount* of £368 – 4*s.* for 15 Months.

An EXAMPLE *for Practice.*

What preſent Money will pay a Debt of £500, due 3 Years, 4 Months hence, allowing *Rebate*, at £6 *per Cent. per Annum*. *Anſ.* £416 – 13 – 4. *Rebate* £83 – 6 – 8. For by the Table your *firſt* Number will be £106 for one Year, your *ſecond* £100, and the *third* the Debt. And, for Proof, find the Intereſt of £416 – 13 – 4 for three Years, and four Months, at £6 *per Cent.* and add it to £416 – 13 – 4, you will have £500 the Debt itſelf.

And by theſe Examples you may find the *Diſcount* at any Rate *per Cent.* and for any Time, by obſerving the foregoing Directions.

Tyro. I ſee the Manner of working this Rule very plainly.

Philo. Then I will give you a Notion of another uſeful Rule, *viz.*

SECTION IV.

EQUATION *of* PAYMENTS.

Tyro. WHAT do you mean by *Equation of Payments?*

Philo. *Equation of Payments* is when a certain Sum of Money becomes due at different Times, or is to be paid at different Payments, and it is agreed between the Debtor and Creditor to ſet, or pitch upon a certain Time for the Payment of the Whole, without any Damage or Loſs to either.

Tyro. This is very pretty as well as uſeful: Pray give me the Rule for working Queſtions of this Sort.

RULE.

Multiply the Sum of each particular Payment by the Time it is to be paid in; then add the ſeveral Products together, and divide the Sum by the whole Debt, and the Quotient is the *Equated*, or juſt Time for the Payments of the Whole.

Queſt. 1. A Merchant buys Goods to the Value of £140, £30 of which is to be paid in 1 Month, £40 in 3 Months, £20 in 4 Months, and £50 in 6 Months; but it is agreed upon an *equated* Time to pay the Whole at once; I demand the *equated*, or juſt Time of Payments?

I ſet down each Payment, and the Time right againſt it, and multiply the Money by the Time, and ſet the Products of each right againſt them, as follows.

£30 multiplied by 1 Mth is £30
40 ——— by 3 Mths is 120 add
20 ——— by 4 Mths is 80
50 ——— by 6 Mths is 300

Debt 140)530(3 Months
420
———
110
30 * *
140)3300(23 Days
280
———
500
420
———
80

Anſ. 3 Months, 23 Days

* * Note,

⁂ *Note*, I multiply by 30, the Days in a Calendar Month, according to the Cuſtom of Buſineſs, becauſe 12 ſuch Months are reckoned to the Year.

Queſt. 2. A Merchant bought Goods to the Value of £500 upon the following Conditions, *viz.* $\frac{1}{4}$th to be paid in two Months, and the Remainder in 6 Months; I demand the *equated* Time to pay the Whole at one Payment?

Firſt, $\frac{1}{4}$ of £500 is	£125	multiplied by 2 Mths	£250
The Remainder is	375	multiplied by 6 Mths	2250
Debt	£500		5|00)25|00
			Anſ. 5 Mths

Now £2500 divided by the Debt 500 is 5 Months for the Anſwer, and thus for any other Queſtion. Do you underſtand it?

Tyro. There can be nothing eaſier to apprehend than this.

QUESTIONS *to exerciſe this* RULE.

3. A Father left his Son £600, to be paid by his Executor, as follows, $\frac{1}{3}$ in 2 Months, $\frac{1}{3}$ in 3 Months, and $\frac{1}{3}$ in 8 Months; but he being very troubleſome to the Executor, and he as willing to be rid of him, they agree upon a Time for the Payment of the Whole at once. The *equated* Time is demanded; *Anſ.* 5 Months.

4. *A* owes *B* £2000 to be paid 3 Months hence; but *A* agrees to pay him £1200 down, provided he will give him a longer Time for the Payment of the Remainder. The Queſtion is, how long Time *B* ought to give him to pay the other £800 in? *Anſ.* $7\frac{1}{2}$ Months.

Tyro. What other Rules are there in Common *Arithmetic?*

Philo. Several others, as *Alligation Medial*, and *Alternate*, *Single* and *Double Poſition*, *Compoſition* of *Medicines*, *Arithmetical* and *Geometrical Progreſſion*, &c. but theſe being not ſo much required in Buſineſs, (or at leaſt may be done by the *Rule of Three Direct*) I ſhall give a little Notion of the two laſt, becauſe it may be of Service to you in Caſe your Fancy ſhould turn to any Part of the *Mathematical* Studies.

DIALOGUE XI.

SECTION I.

Of ARITHMETICAL PROGRESSION.

Tyro. WHAT do you mean by *Arithmetical Progreſſion?*

Philo. *Arithmetical Progreſſion* is by ſome called *Comparative Arithmetic*, becauſe in a Series of Numbers one is compared with another, in Order to know what Ratio or Proportion one bears to the other; that is, in what Manner they differ, and how much, and that Difference is always equal in Numbers that are continued.

OBSERVATION.

1. Let us take any Numbers that differ alike from one another: Thus, 3, 6, 9, 12, 15, *&c.* differ by 3, called the common Exceſs, Difference, or *Ratio*. Alſo, 1, 9, 17, 25, 33, are Numbers in *Arithmetical Progreſſion*, whoſe *Ratio*, or common Difference is 8.

2. In any Series of Figures in *Arithmetical Progreſſion*, when the Number of Places is odd, *viz.* 3, 7, 11, 15, 22, or the like, the Double of the middle Figure, or Place, is equal always to the Sums of the firſt and laſt Figure; thus, 2, 6, (10) 14, 18. The Double of the middle Term 10 is equal to the Sum of the firſt and laſt Number, *viz.* 20. So 3, 8, 13, (18) 23, 28, 33. The middle Term 18 doubled is equal for the Sum of 3, and 33, *viz.* 36.

Tyro. How many Caſes are there in this *Rule?*

Philo, Six; but *two* of them will be ſufficient for your Purpoſe in working Queſtions in general, or to give you a true Notion of the Nature of the Rule itſelf.

CASE 1.

The Number of Places, or Terms, and the *Ratio*, or common Exceſs, being given to find that laſt Number.

Multiply the Number of Places leſs by 1, by the *Ratio*, or common Exceſs, and to that Product add the firſt Number, and that Sum will be equal to the laſt Number.

1. Let the firſt Number be 3, Number of Places 7, and common Exceſs 5, what is the laſt Number?

Here the Number of Places is 7, therefore, I count them for 6, (which is leſs 1) and the *Ratio*, or common Exceſs, is 5, now 5 Times 6 is 30; then I add the firſt Number, *viz* 3, and it is 38, the laſt Number, and ſo on if the Places were ever ſo many.

2. Let the Number of Terms be 121, the firſt Number 5, and the common Exceſs, or *Ratio*, 9; I demand the laſt Number?

Here the Number of Places leſs by 1 is 120, which multiplied by 9, the *Ratio*, gives 1080, to which add the firſt Number 5, gives 1085, the laſt Number. And this you may prove by ſetting them down thus, 5, 14, 23, 32, 41, till you have 121 Places, and your laſt Number will be 1085.— But how tedious is this! Since you ſee the laſt Number is ſo eaſily found.

A QUESTION *for Exerciſe.*

A Traveller ſets out, and the firſt Day went 6 Miles, the ſecond Day 9, increaſing every Day's Journey 3 Miles, and travelled 61 Days; how many Miles did he go the laſt Day? *Anſ.* 186 Miles. See the next *Caſe.*

CASE 2.

The Extremes, that is, the firſt and laſt Number, and the Number of Terms being given to find the Aggregate, or total Sum of all the Series of Numbers,

Add the firſt and laſt Number together, and multiply that Sum by half the Number of Places, and the Product is the Sum of all the Series. Or in Caſe the Number of Terms be odd, then add the laſt Numbers together, and multiply that Sum by the Number of the Terms, and divide that Product by 2, and you have the Total of all the Places.

Thus, in the laſt Queſtion concerning the Travels, the firſt Number is 6, the laſt Number 186 Miles, and the Places 61. Therefore, by the Rule, add the firſt Number 6, and the laſt Number 186 together, and it is 192, which I multiply by 61, and it is 11712, and dividing by 2, I have 5856, the Miles he went in all in 61 Days.

A QUESTION

A QUESTION *for Exerciſe.*

Queſt. 2. Suppoſe 100 Stones be placed in a ſtraight Line, at a Yard diſtant from each other, and a Perſon undertakes to pick one up at a Time, and bring it back to the Place where he firſt ſet out; how far will he have gone when he has picked up the Whole.

Here the Number of Places are 100, and as the Stones are but one Yard from each other, the common Exceſs is but 1, and therefore, the laſt Number is alſo 100. But here you are to conſider, the Man is to come back with every Stone; therefore, when he fetches the firſt Stone in coming back, he goes in 2 Yards to put the firſt Stone, therefore, 2 is your firſt Number, and by the ſame Rule 200 will be your laſt Number.

Laſt Number	200
Firſt Number	2
	202
Half of the Number of Places	50

He goes in all 10100 Yards, which reduced into Miles, is $5\frac{1}{2}$ Miles, and 420 Yards, which wants but 20 Yards of $5\frac{3}{4}$ Miles.

Queſt. 3. Suppoſe Stones were laid one Yard aſunder, in a right Line, for one Mile in Length, and to be picked up one by one, coming back with one at a Time; how far would the Perſon go that performs it, *Anſ.* 1761 Miles.

SECTION II.

Of GEOMETRICAL PROGRESSION.

Tyro. I AM mightily pleaſed with what you have ſhewn me; but pray what is *Geometrical Progreſſion*, and wherein does it differ from the other?

Philo. *Geometrical Progreſſion*, or *Proportion*, is when Numbers differ from one another, by the like *Ratio*, or Reaſon, as in *Arithmetical Progreſſion*, only with this Difference, that the former is the Effect of *Addition*, and here of *Multiplication*, all the Numbers having one common Multiplier. As 2, 4, 8, 16, differ by double Reaſon, or the *Ratio* is 2; for twice 2 is 4, twice 4 is 8, *&c.* So alſo, 1, 7, 49, 343, *&c.* Here the *Ratio* is 7, for 7 Times 1 is 7, and 7 Times 7 is 49, *&c.* So that you ſee it is *Multiplication.*

Tyro. I thank you Sir: What elſe pray?

NOTE 1.

Philo. Any three Numbers differ in *Geometrical Progreſſion*; the Product of the *Extremes*, that is, the Product of the *firſt* and *laſt* Number, is equal to the Square of the *Mean*, that is, equal to the middle Number multiplied by itſelf.

Let 4, 12, and 36 be the 3 Numbers, whoſe *Ratio* is 3, that is, each is 3 Times more than the foregoing Number; then will the Product of the Extremes 4 and 36 be equal to the Square of 12, the *Mean*, *viz.* equal to 144. So alſo 2,16, and 18. Here 128 multiplied by 2 is equal to 16 multiplied by 16 equal to 256.

NOTE 2.

Any 4 Numbers that differ in *Geometrical Proportion*, either continued or interrupted (provided the Interruption or breaking off be between the *ſecond* and *third* Number)

Number) the Product of the *Means* is equal to the Product of the *Extremes*; that is, the Product of the *firſt* and *fourth* is equal to the Product of the *ſecond* and *third* Numbers.

Let the 4 Numbers be 3, 12, 48, and 192, whoſe *Ratio* is 4. Here 192 multiplied by 3, the *firſt* Number, is equal to 48 by 12, *viz.* equal to 576.

Again, Suppoſe the Numbers be interrupted, as 5, 30, 448, and 2688. Here the *ſecond* Term is 6 Times more than the *firſt* Term, and the *fourth* Term 6 Times more than the *third*: Therefore, 2688 multiplied by 5 is equal to 448 multiplied by 30.

Note, This Mark (∺) ſtands for *Geometrical Progreſſion.*

NOTE 3.

The *Ratio* of any Numbers in ∺ is found by dividing any Conſequent by its Antecedent; that is, dividing any Number by the foregoing Number. Thus, the *Ratio* of the laſt Numbers is found by dividing 30 by 5, or 2688 by 448, which gives 6, the *Ratio.*

Tyro. I underſtand this very well; but in a long Series of Numbers, how am I to find the laſt Number?

Philo. This is very eaſily done, and as you have not the Rule in many, or, at leaſt, have it but for certain *Ratio*, or Difference of Numbers, I ſhall give you one ſtanding Rule, be the *firſt* Number and the *Ratio* what it will.

CASE 1.

To find the laſt Number in any Series in ∺ having the *firſt* Number and *Ratio* given, ſet down your *firſt* Number, and multiply it by the *Ratio*, and that Product again by the *Ratio*, or common Difference, and thus go on for 5 or 6 Terms, at Pleaſure; then multiply any of thoſe Places by itſelf, and divide the Product thereof by the *firſt* Number, and it will be the Double of that Number, wanting one Place. Thus, Suppoſe you multiply the 6th Place by itſelf, and divide by the *firſt* Number, the Quotient will be the 11th Place; then, if you multiply the 11th Place by itſelf, and divide by the *firſt* Number, the Quotient will be the 21ſt Place, which is the Double of 11, wanting 1.

☞ *N. B.* When the firſt Term is Unity, or 1, there is no Occaſion to divide; for having multiplied by the *Ratio* a few Times, as before directed (ſuppoſe as far as the 6th Place) this Term multiplied by itſelf will be the Product of the Double of Terms wanting 1, as was ſaid before.

Tyro. I am obliged to you, Sir; but how ſhall I find the Sum of all the Series?

Philo. By the next Caſe.

CASE 2.

The Ratio, *(or Common Difference) and the laſt Number being given to find the Aggregate, or total Sum of all the Series,*

1. Multiply the laſt Term, or Number, by the Common Difference, or *Ratio*, and from that Product take the *firſt* Number; then divide the Remainder by the Common Difference, leſs 1, and the Quotient will be the Sum of all the Series. Or,

2. Multiply the *ſecond* and laſt Term together; then multiply the *firſt* Term into itſelf, and take that Product from the Product of the *ſecond* and laſt Term; then divide the Remainder the *ſecond* Term, leſs 1, the *firſt* Term will give the Sum of all the Series.

Tyro. Pleaſe to give me one Example.

Philo. I will give you a practical Queſtion to exerciſe both Caſes.

Queſt. A cunning Jockey had a fine Gelding, to which a Gentleman took a particular Fancy, and after many Words had paſſed between them, the Jockey agreed to ſell him to the Gentleman for the Price his Shoes would come to at one Farthing for the *firſt* Nail, and to double the Price every Nail: Now the Number of Nails in the Gelding's Shoes were 28, I demand then what he was ſold for at this Rate?

Now obſerve, *Tyro*, Here the common Exceſs is 2, (that is, a Farthing a Nail doubled) Now to find the laſt Number by *Caſe* 1, double a few Places, ſuppoſe as far as the 7th, which will be 64; then multiply 64 by itſelf, *viz.* 64, you have 4096, the 13th Place, which doubled, gives the 14th Place, *viz.* 8192. This multiplied by itſelf gives the 27th Place, which doubled, gives the 28th, or laſt Place, *viz.* 134217728 Farthings; then proceed according to *Caſe* 2, you will find the Sum of all the Series to be 268435455 Farthings, which is £279620 5*s.* 3*d.* ¾. a Sum too large for the ignorant Purchaſer. And had there been but 4 Nails more in his Shoes (*viz.* 32) he would have come to £4473924 5*s.**

---

* It is no eaſy Taſk to make ſome Perſons believe the Truth of the Increaſe of Figures in *Geometrical Progreſſion* in theſe Queſtions; but ſuppoſe a Servant was to agree with his Maſter to ſerve him thirty Years, for 1 ſingle Wheat Corn the firſt Year, for the ſecond Year 10, for the third 20, and ſo on. The Produce of the Wheat would be more than all the Ships in *England* could carry away at once; and the Money for his Wages would be more than all the Land could pay ſold at 20 Years Purchaſe for ever.

SECTION III.

Of PERMUTATION, *or Variety of Changes.*

Tyro. I Imagine this is much after the the ſame Manner as *Progreſſion*; is it not?

Philo. This ſhews the Increaſe of Numbers as well as the other; but does not teach you to find the Sum of all, only their different Variations, or Changes, as follows.

Multiply every Number together, that is, the *firſt* by the *ſecond*, and that Product by the *third* Figure, and ſo on, till you have gone through all the given Numbers; ſo is the laſt Product the Variety of Changes.

EXAMPLE.

I demand the Changes that may be rung on 12 Bells, or the different Poſition 12 Perſons may ſit at Table. *Anſ.* 479001600.

☞ *Note*, This Sign (×) ſignifies, that all Numbers between which it ſtands are to be multiplied continually one into the other, thus: Take the 12 Bells, and multiply the *firſt* by the *ſecond*, you have two Changes upon two Bells; multiply this by the *third* Bell, you have 6 on three Bells; multiply this Product by 4, or the *fourth* Bell, you have 24 Changes, &c. as follows.

Thus, 1×2×3×4×5×6×7×8×9×10×11×12 will produce 479001600 Changes, or different Poſitions; which you may prove very eaſily at Leiſure by *Multiplication* only *.

---

* Notwithſtanding the Changes on 8 Bells may be rung out in a few Hours; yet the Changes on 12 (allowing 10 Changes in a Minute) will take 91 Years, 26 Days; and to add to the Incredibility of this Increaſe, two Bells more, *viz.* 14, would take up 16575 Years to ring the Changes through. See Mr. *Ward*, p. 85.

Tyro. I thank you for giving me a ſhort Hint of theſe Things, which I perceive the Nature of very plainly: And now, pray, what will you inſtruct me in next?

Philo. There are two or three Rules, ſuch as the *Rule of Falſe*, *Allegation*, *Alternate*, *Compoſition of Medicines*, which are not material in Buſineſs, and therefore for Want of Room muſt be omitted, and the more neceſſary Part, *viz. Vulgar Fractions*, be treated of in their Stead. And here I beg you would take Care and make yourſelf Maſter of *Vulgar Fractions*, they being very neceſſary in almoſt every Branch of Life, and the very Foundation of *Decimals*.

DIALOGUE XII.

SECTION I.

Of Notation of VULGAR FRACTIONS.

Tyro. WHAT do you mean by *Notation?*

Philo. Notation, like *Numeration*, ſhews you how to note, write down, or expreſs any *Fraction*.

Tyro, What is a *Vulgar Fraction?*

Philo. It is a broken Number, or a Part, or Parts of an Integer, or whole Number, and conſiſts of two Parts, *viz.* the *Numerator*, which always ſtands a-top, and the *Denominator*, which always ſtands under it, or below. Thus, $\frac{4}{5}$, $\frac{3}{4}$, $\frac{11}{12}$. Here 4, 3, and 11 are the *Numerators*, and 5, 4, and 12 the *Denominators*.

Tyro. How many Sorts of *Vulgar Fractions* are there?

Philo. Three, *viz. Firſt*, *Simple*, *Single*, or *Proper Fractions* (for theſe are all one.) *Secondly*, *Improper*; and *thirdly*, *Compound Fractions*.

Tyro. What is a *Simple Fraction*, or how is it known?

Philo. *Simple Fractions* have their *Numerators* leſs than their reſpective *Denominators*. Thus, $\frac{1}{2}$, $\frac{3}{4}$, $\frac{5}{9}$, $\frac{14}{87}$, *&c.* are all *Simple Fractions*.

Tyro. What is an *Improper Fraction?*

Philo. *Improper Fractions* have their *Numerators* larger than their *Denominators*. Thus $\frac{4}{3}$, $\frac{9}{5}$, $\frac{87}{14}$, $\frac{127}{8}$, &c. are *Improper Fractions*.

Tyro. What are *Compound Fractions?*

Philo. *Compound Fractions* are *Fractions of Fractions*, compounded, or joined together by the Word *of*. Thus, $\frac{2}{3}$ of $\frac{3}{5}$, or $\frac{3}{4}$ of $\frac{5}{6}$ of $\frac{11}{12}$ are *Compound Fractions*, and are thus read, 2 Thirds of 3 Fifths, or 3 Fourths of 5 Sixths of 11 Twelfths of an *Integer*, or *Whole Number*.

Tyro. I underſtand you, Sir; but this is very difficult to tell ſurely.

Philo. You have Nothing to do with this at preſent; You will know it by and by.

Tyro. What do you mean by a *Mixt Number?*

Philo. A *Mixt Number* is a *whole* Number with a Fraction after it. Thus, 14 $\frac{2}{5}$, and 147 $\frac{5}{8}$ are *Mixt Numbers*.

Tyro. I underſtand you; but how am I to find the the Value of different *Fractions*.

Philo. By *Reduction*, which is always learned firſt, becauſe you can't *add*, *ſubtract*, *multiply*, or *divide*, till the Fractions are firſt reduced to their proper Order: But before you proceed any farther, it will be proper to learn the following Signs, or Characters by Heart, ſo as to know what they ſignify, which will be a great Help to you.

Of the Signs uſed in Vulgar Fractions.

This (=) is the Sign of Equality, and ſignifies, that the Numbers before it are equal to thoſe after it. Thus, 5 and $2=7$ is thus read, 5 and 2 is *equal to* 7.

This Mark (+) is the Sign of *Addition*, and ſignifies all the Numbers are to be added together. Thus, $2+6+7=15$: That is, 2 *more* 6 *more* 7, or 2 added to 6 and 7 is *equal* to 15.

This (—) is the Sign of *Subtraction*, and ſignifies the Number after it is taken, or is to be taken out of the Number before it. Thus, 15—7=8, that 7 taken, or ſubtracted from 15, is *equal to* 8.

This (×) is the Sign of continual Multiplication.

This (÷) is the Sign of *Diviſion*, and ſignifies the Number before it is to be divided by the Number that follows it. Thus, 56÷8=7, that is, 56 divided by 8 is *equal to* 7.

SECTION II.

Reduction of VULGAR FRACTIONS.

CASE I.

To reduce a Mixt Number *to an* Improper Fraction.

MULTIPLY the whole Number by the Denominator of the Fraction, and take in the Numerator beſides; then place the Denominator under the Product, and it is done.

Reduce 57 $\frac{3}{5}$ to an *Improper Fraction?*

$$\begin{array}{r} 57\,\frac{3}{5} \\ 5 \\ \hline 288 \\ \hline 5 \end{array} \quad \textit{Anſ.}\ \frac{288}{5}$$

Reduce 1753 $\frac{11}{12}$ to an *Improper Fraction?* *Anſ.* $\frac{21047}{12}$.

CASE 2.

To reduce an Improper Fraction *to a* Whole *or* Mixt Number.

Divide the *Numerator* by the *Denominator*, and if any Thing remains, place it for a new *Numerator* over the *Denominator*.

Reduce $\frac{288}{5}$ to a *Mixt Number?*

$$5)288$$

$$57\frac{3}{5}.\ \textit{Anſ.}$$

Reduce $\frac{21047}{12}$ to a *Mixt Number?* *Anſ.* $1753\frac{11}{12}$.

☞ This is only a Proof to the foregoing *Caſe*, and is the ſame Queſtion backwards.

CASE 3.

To Reduce or make a Whole Number into an Improper Fraction.

Multiply the Whole Number by any Figure at Pleaſure, and place the Product over the Figure you multiplied by, and you have an *Improper Fraction* equal to the given *Whole Number*.

Reduce 14 to an *Improper Fraction*, whoſe Denominator muſt be 9? *Anſ.* $\frac{126}{9}$.

Here becauſe it ſays 9 muſt be the Denominator, I multiply 14 by 9, and it is 126, which I place over the 9, and it is done. *Anſ.* $\frac{126}{9}$.

NOTE

NOTE 1.

To expreſs any *Whole Number* Fraction-wiſe, it is only putting Unity, or 1 under it. Thus, 14, 26, 490, *&c.* will be $\frac{14}{1}$, $\frac{26}{1}$, $\frac{490}{1}$, &c. Remember this, for it is very uſeful.

NOTE 2.

Every *Improper Fraction* is more than an Unit, or 1, and every *Simple Fraction* is leſs than Unity, or 1. Thus, the *Simple Fraction* $\frac{3}{4}$ of a £. Sterling, is but 15 Shillings: but $\frac{4}{3}$ of a £. Sterling is £1, and $\frac{1}{3}$ over; for if you divide 4 by 3, it is 1, and $\frac{1}{3}$, that is, £1 – 6 – 8.

NOTE 3.

When the Numerator and Denominator are alike, the Fraction is equal to a Whole Number. Thus, $\frac{4}{4}$ is 1, or $\frac{25}{25}$ is equal to 1; becauſe the Numerator divided by the Denominator produces 1.

CASE 4.

To reduce a Compound Fraction *to a* Simple *one, of the ſame Value.*

Multiply all the Numerators together for a new Numerator, and all the Denominators for a new Denominator.

N. B. N. N. ſignifies *New Numerator*, and *N. D. New Denominator*, and *C. D. Common Denominator*, which pray remember.

1. Reduce $\frac{2}{5}$ of $\frac{3}{4}$ of $\frac{5}{8}$ to a *Simple Fraction?* *Anſ.* $\frac{30}{160}$.

For $2 \times 3 \times 5 = 30$ *N. N.* and $5 \times 4 \times 8 = 160$ *N. D.*

That is, 2 multiplied by 3, and that Product by 5, is equal to 30 *N. N*; and 5 multiplied by 4, and that Product by 8, is equal to 160 *N. D.* *Anſ.* $\frac{30}{160}$.

☞ *Note*, When there are Cyphers in the Numerator and Denominator, then cut them off, and the *Fraction* is ſtill the ſame. Thus, in the foregoing Anſwer the *Fraction* is $\frac{30}{160}$, *viz.* $\frac{3}{16}$. So $\frac{4000}{7000}$ is only $\frac{4}{7}$.

2. Reduce $\frac{3}{5}$ of $\frac{5}{6}$ of $\frac{7}{8}$ of $\frac{11}{12}$ to a *Simple Fraction.* *Anſ.* $\frac{1155}{2880}$.

CASE 5.

To reduce a Fraction *to its loweſt Terms, that ſhall be equal to the original given* Fraction.

Divide the Numerator and Denominator by any Figure that will divide them without any Remainder; ſo ſhall the laſt Quotients be a New Numerator, and a New Denominator equal to the given Fraction.

1. Reduce $\frac{72}{120}$ into its loweſt Terms? *Anſ.* $\frac{3}{5}$.

Diviſors, $\overset{2}{\smile}\ \overset{6}{\smile}\ \overset{2}{\smile}$

$\frac{72}{120}\Big|\frac{36}{60}\Big|\frac{6}{10}\Big|\frac{3}{5}$ *Anſ.* $\frac{3}{5}=\frac{72}{120}$. So alſo $\frac{168}{448}$ is $=\frac{3}{8}$, which you may prove by dividing the Numerator and Denominator by any Figures that will divide them both, as was ſaid before.

Note, There is another Way to reduce a Fraction to its loweſt Terms at once, and that is by finding a common Meaſurer.

To find a common Meaſurer.

Divide the Denominator by the Numerator, and if any Thing remains, divide the laſt Diviſor by ſuch Remainder, and if any Thing again remains, divide the laſt Diviſor thereby: Thus go on till Nothing remains, and your laſt Diviſor is the *Common Meaſurer*, or Number, that will divide the Numerator and Denominator at once into their loweſt Terms.

1. Reduce $\frac{168}{448}$ into its loweſt Terms. *Anſ.* $\frac{3}{8}$.

```
                   168)448(2
                       336
                       ---
                       112)168(1
                           112
                           ---
Common Meaſurer             56)112(2
                               112
                               ---
                                 0
```

Here I divide the *Denominator* 448 by the *Numerator* 168, and 112 remains; then I divide 168, the laſt Diviſor, by that 112, and 56 remains; *laſtly*, I divide 112 by 56, and 0 remains: So is 56 the *Common Meaſurer*, that will divide both at one Work.

```
56)168(3 N. Numerator      56)448(8 N. Denominator.
   168                        448
   ---                        ---         Anſ. 3/8=168/448.
    0                          0
```

2. Reduce $\frac{512}{1280}$ to its loweſt Terms. *Anſ.* $\frac{2}{5}$.

CASE 6.

To reduce Fractions of different Denominators to Fractions of the ſame Value, having one common Denominator.

Firſt, Multiply all the Denominators together for a common Denominator; then begin with the firſt Numerator, and multiply it into all the Denominators, except its own Denominator: Do thus with all the other Numerators, multiplying them into all the Denominators except their own; ſo will theſe Products be *New* Numerators, which muſt be placed over the *Common* Denominator, and each *Fraction* will be equal to *that* Fraction whoſe Numerator you multiplied into the Denominators.

1. Reduce $\frac{2}{3}$, $\frac{3}{5}$, and $\frac{5}{8}$ to Fractions, having one *Common* Denominator.

Ferſt, I multiply all the Denominators together, and it makes 120 for a *C* Denominator. That is, $3\times5\times8=120$ *C. D.* Then I begin with the Numerator 2, that is, $2\times5\times8=80$ *N N.* Then the Numerator $3\times3\times8=72$.*NN.* And *laſtly*, $5\times5\times3=75$ *NN.* Theſe New Numerators I place over the *C* Denominator, and the Work is done. Thus, $\frac{80}{120}=\frac{2}{3}$ for 80 is $\frac{2}{3}$ of 120. Alſo, $\frac{72}{120}=\frac{3}{5}$ and $\frac{75}{120}=\frac{5}{8}$.

2. Reduce $\frac{3}{4}$, $\frac{5}{6}$, $\frac{7}{8}$ and $\frac{4}{5}$ to Fractions having one C. Denominator. *Anſ.* $\frac{720}{960}=\frac{3}{4}$, $\frac{800}{960}=\frac{5}{6}$, $\frac{840}{960}=\frac{7}{8}$ and $\frac{768}{960}=\frac{4}{5}$.

CASE 7.

To reduce Fractions *of one Name or Denomination to another.*

1. ASCENDING.

When a *Fraction* is to be reduced from a leſs to a greater Denomination, then make the given *Fraction* into a Compound *Fraction*, by conſidering how many of the *Leſs* make one of the *Greater* Denomination; then reduce this *Compound Fraction* to a ſimple one, and it is done.

1. Reduce $\frac{1}{4}$ of a Penny to the Fraction of £. Sterling. *Anſ.* $\frac{1}{960}$£.

Here, becauſe 12 Pence make 1 Shilling, and 20 Shillings a £. I ſay, $\frac{1}{4}$ of $\frac{1}{12}$ of $\frac{1}{20}$, which reduced to a *Simple Fraction* by multiplying the Numerators together for a *N. N.* and all the Denominators for a *N. D.* gives $\frac{1}{960}$ of a £=$\frac{1}{4}$ of a Penny.

2. Reduce $\frac{3}{4}$ of a Farthing to the Fraction of a Guinea? *Anſ.* $\frac{3}{4032}$, *viz.* $\frac{3}{4}$ of $\frac{1}{4}$ of $\frac{1}{12}$ of $\frac{1}{21}$= $\frac{3}{4032}$ *Anſ.*

2. Reduce $\frac{1}{4}$ of *lb.* to the Fraction of a Ton. *Anſ.* $\frac{1}{8960}$.

2. DESCENDING.

When the *Fraction* is to be brought from a *greater* to a *leſs* Denomination, then make of it a *Compound Fraction*, as before; deſcending from the *great* to *leſſer* Denomination: Then multiply every Denominator by the Numerator of the given *Fraction*, (except its own Denominator) and place the Product over the Denominator of the ſaid given Fraction, you have the Anſwer.

N. B. This *Caſe* is a Proof to the laſt.

1. Reduce $\frac{1}{960}$ of a £. Sterling to the Fraction of a Penny? *Anſ.* $\frac{240}{960}$, or $\frac{1}{4}$. For $\frac{1}{960}$ of $\frac{1}{20}$ of $\frac{1}{12}$. Now the Numerator 1 multiplied into the Denominator 20, and 12 is=240, which I place over the Denominator 960, thus, $\frac{240}{960}$ *Anſ.*

2. Reduce $\frac{3}{4032}$ of a Guinea to the Fraction of a Farthing? *Anſ.* $\frac{3024}{4032}$. For it is $\frac{3}{4032}$ of $\frac{1}{21}$ of $\frac{1}{12}$ of $\frac{1}{4}$. Now 3×21×12×4=3024 *N N.*

CASE 8.

To find the Value of a Fraction *in* Money, Weight, *or* Meaſure.

Multiply the Numerator of the Fraction by the next neareſt Part belonging to the Integer itſelf, and divide by the Denominator; then multiply the Remainder by the next neareſt Part of the Integer, and divide by the ſame Diviſor, or Denominator, and thus go on till you have gone thro' all the Parts of the Integer, and the Quotients will be your Anſwer.

1. What is the Value of $\frac{26}{30}$ of a £. Sterling? *Anſ.* 17*s.* 4*d.*

26 *Numerator*
20
———
3|0)52|0
———
17*s.* 10*d.*
12
———
3|0)12|0
———
4*d.*

Here I multiply the Numerator 26 by 20, the Shillings in a £. and divide by the Denominator 30, gives £17, and 10 over, which I multiply by 12, and divide again by 30, gives 4 Pence; therefore, I find $\frac{26}{30}$ of a £. to be 17*s.* 4*d.*

2. What is the $\frac{15}{216}$ of a Moidore? *Anſ.* 1*s.* 10*d.* $\frac{1}{2}$, as by the following Work.

15 *Numerator*
27 *multiply*
———
216) 405(1*s.*
216
———
189
12
———
216) 2268(10*d.*
216
———
108
4
———
216) 432(2 *qr*
432
———
0

Here I multiply the Numerator 15 by 27, the Shillings in a Moidore, and divide by the Denominator, gives 1 Shilling, and 189 over, which I multiply by 12, and divide by 216, as before, and ſo I go on, as appears by the Work, and find $\frac{15}{216}$ of a Moidore to be 1*s.* 10*d.* $\frac{1}{2}$.

Anſ. 1*s.* 10*d.* $\frac{1}{2}$.

Tyro. I ſee the Nature of it plainly; and like this *Caſe* very well; for it is diverting as well as improving.

Philo. You are to proceed the ſame in *Weight* and *Meaſure*; therefore, I ſhall only ſet you a few Queſtions for Practice to try at Leiſure.

3. What is the $\frac{324}{972}$ of a Ton? *Anſ.* 6 C. 2 *qrs.* 18 *lbs.* 10 *oz.* 10 *dr.* $\frac{648}{972}$.

4 What is the $\frac{14}{112}$ of a Barrel? *Anſ.* 4$\frac{1}{2}$ Gallons.

5. What is the $\frac{150}{225}$ of a Mile? *Anſ.* 1173 Yards, 1 Foot.

6. What is the $\frac{14}{16}$ of an Acre? *Anſ.* 3 Roods, 20 Rods.

7. What is the $\frac{5}{12}$ of a Year (allowing 365 Days) *Anſ.* 152 Days, 2 Hours.

SECTION III.

ADDITION *of* VULGAR FRACTIONS.

Tyro. HOW are *Vulgar Fractions* added together?

Philo. Very eaſily, by this one Rule, *viz.* All *Compound Fractions* muſt be reduced to *Simple* ones, and all Fractions of different Denominators, to a *Common* Denominator; then add all the Numerators together, and place their Sum over the *Common* Denominator, is the Anſwer; and if it be an *Improper* Fraction at laſt, then reduce it to a *Mixt* Number, and the Work is done.

1. Add $\frac{2}{11}$ $\frac{1}{11}$ $\frac{3}{11}$ and $\frac{4}{11}$ together. *Anſ.* $\frac{10}{11}$.

Here being one *Common* Denominator to all the Fractions, I only add the Numerators together, and the Work is done. *Anſ.* $\frac{10}{11}$.

2. Add $\frac{25}{27}$ $\frac{14}{27}$ and $\frac{19}{27}$ together. *Anſ.* $\frac{58}{27}=2\frac{4}{27}$.

Here I find the Sum of all the Numerators to be 58, which I place over the Denominator 27; but being an *Improper* Fraction, I divide 58 by 27, and have for *Anſwer* 2 and $\frac{4}{27}$.

3. Add $\frac{2}{3}$ $\frac{3}{5}$ and $\frac{5}{8}$ together. *Anſ.* $\frac{227}{120}$.

Here the *Fractions* having different Denominators, I reduce them (by *Caſe* 5) to a common Denominator, and find them to be $\frac{80}{120}$, $\frac{72}{120}$, and $\frac{75}{120}$. Then I add theſe Numerators together, and find them 227: So the Anſwer is $\frac{227}{120}=1\frac{107}{120}$.

4. Add $\frac{2}{3}$ of $\frac{3}{5}$ and $\frac{1}{2}$ of $\frac{3}{8}$ together. *Anſ.* $\frac{144}{240}$.

Firſt, $\frac{2}{3}$ of $\frac{3}{5}$ is $= \frac{6}{15}$, and $\frac{1}{2}$ of $\frac{3}{8} = \frac{3}{16}$. Now $\frac{3}{16}$ and $\frac{6}{15}$ reduced to a *C D* is $\frac{45}{240}$, and $\frac{96}{240}$, which added together is $\frac{141}{240}$. *Anſ.*

5. Add £14 $\frac{3}{5}$ £19$\frac{2}{3}$ £47 $\frac{5}{8}$ and £100 together. *Anſ.* £181 $\frac{107}{120}$, or 17*s.* 10*d.*

6. What muſt I add to £54 $\frac{2}{3}$, and 19 $\frac{3}{5}$ to make it £100? *Anſ.* 25 $\frac{11}{15}$.

SECTION IV.

SUBTRACTION *of* VULGAR FRACTIONS.

Tyro. HOW is *Subtraction of Fractions* performed?

Philo. By the ſame Rule as in *Addition*, firſt reducing all *Compound* to *Simple*, and all to a *Common* Denominator; thus, *ſubtract* the Numerator of the *leſs* Fraction from the Numerator of the other, and place the Difference over the Denominator, is the Anſwer.

From	$\frac{14}{29}$		From	£67 $\frac{21}{47}$
Take	$\frac{11}{29}$		Take	18 $\frac{15}{47}$
Difference	$\frac{3}{29}$	*Anſ.*	*Anſ.*	49 $\frac{6}{47}$
Proof	$\frac{14}{29}$		Proof	67 $\frac{21}{47}$

Here in both theſe Examples I take the Numerator of the *leſs* Fraction from the Numerator of the top, or *greater* Fraction, and place the Difference over the Denominator. Then I prove the Work, as in common *Subtraction*, by adding the Numerator of the Difference to the Numerator of the *leſs* Fraction, and it gives the Numerator of the top Fraction. And thus for all Examples of this Sort.

Tyro. I underſtand you very well, Sir; but ſuppoſe the Numerator of the Fraction to be ſubtracted be larger than the Numerator of the Fraction I am to take it out of, how am I to do then?

Philo. This is eaſy enough: For when you cannot take the lower Numerator out of the top Numerator; then take it out of the common Denominator, and to that Difference add the top Numerator, and place it over the Denominator for the true Difference; only pray remember this is called *borrowing*, as in common *Subtraction*, and you muſt carry one to the next Figure for ſo doing.

2. Lent	$134\frac{14}{24}$	is =	£ 134-11-8
Received	$95\frac{18}{24}$	is =	95-15-
Due	$38\frac{20}{24}$	*Anſ.* is =	£ 38-16-8
Proof	$134\frac{14}{24}$	Proof	£ 134-11-8

The PROOF *by common* Subtraction.

3. From $\frac{2}{3}$ of $\frac{3}{5}$ take $\frac{1}{2}$ of $\frac{3}{8}$. That is, from $\frac{6}{15}$ take $\frac{3}{16}$. Now $\frac{6}{15}$ is $\frac{96}{240}$, and $\frac{3}{16}$ is $\frac{45}{240}$. Then I take $\frac{45}{240}$ from $\frac{96}{240}$ and there remains $\frac{51}{240}$. *Anſ.*

4. From 1 take $\frac{4}{11}$. *Anſ.* $\frac{7}{11}$. For I make an *Improper* Fraction equal to 1, which has a Denominator equal to the Fraction to be ſubtracted, *viz.* $\frac{11}{11}$ is = 1. Then $\frac{7}{11}$ from $\frac{11}{11}$ remains $\frac{4}{11}$. And thus for any other Example.

SEC-

SECTION V.

MULTIPLICATION *of* VULGAR FRACTIONS.

Tyro. HOW is *Multiplication* performed?

Philo. The Fractions muſt be reduced to *Simple* ones, as before directed, and *Mixt* Numbers to *Improper* Fractions. Then the Rule is, Multiply the Numerators together for a new Numerator, and the Denominators together for a new Denominator, and the Work is done.

1. Multiply $\frac{4}{7}$ by $\frac{3}{6}$. *Anſ.* $\frac{12}{42}$. For 4×3=12 *N. N.* 7×6=42 *N. D.*
2. Multiply $\frac{247}{6}$ by $\frac{4}{9}$. *Anſ.* $\frac{988}{54}$=18 $\frac{16}{54}$.
3. Multiply 4*d.* $\frac{1}{2}$ by 4*d.* $\frac{1}{2}$. *Anſ.* 20*d,* $\frac{1}{4}$.

First, I reduce 4 $\frac{1}{2}$ to an *Improper* Fraction, which is $\frac{9}{2}$; therefore, I multiply $\frac{9}{2}$ by $\frac{9}{2}$. *Anſ.* $\frac{81}{4}$=20$\frac{1}{4}$, as before.

4. Multiply £4 $\frac{3}{8}$ by £2. Here £4 $\frac{3}{8}$=$\frac{35}{8}$, and £2 is expreſſed in Fractions $\frac{2}{1}$; therefore, multiply $\frac{35}{8}$ by $\frac{2}{1}$. *Anſ.* $\frac{70}{8}$=£8 $\frac{6}{8}$, *viz.* £8. 13*s.* 4*d.* wrong

5. Multiply $\frac{2}{3}$ of $\frac{5}{8}$ by $\frac{3}{7}$ of $\frac{1}{5}$, that is, $\frac{10}{24}$ by $\frac{3}{35}$. *Anſ.* $\frac{30}{840}$=$\frac{3}{84}$. And thus may any Sum be multiplied by another, with more Exactneſs than by any other Rule, though not ſo eaſy as *Decimal Fractions.*

SECTION VI.

DIVISION of VULGAR FRACTIONS.

Tyro. HOW is *Diviſion* of Fractions performed?

Philo. Firſt, Reduce all *Compound* to *Simple* Fractions, and all *Mixt* Numbers to *Improper* Fractions, as before directed: Then the Rule is, Multiply the Numerator of the Dividend into the Denominator of the Diviſor, for a new Numerator, and the Numerator of the Diviſor (or Fraction you divide by) into the Denominator of the Dividend for a new Denominator, and you have the Anſwer.

1. Divide $\frac{8}{19}$ by $\frac{5}{12}$. *Anſ.* $\frac{96}{95} = 1\frac{1}{95}$. Here I multiply 8 into 12, which is 96, for a new Numerator, and 5 into 19, which is 95, for a new Denominator, which is $\frac{96}{95}$. Here you ſee the Anſwer is an *Improper* Fraction; but if you change the Fractions, that is, if $\frac{5}{12}$ were to be divided by $\frac{8}{19}$, then the Anſwer would be $\frac{95}{96}$, which is a *Simple* Fraction.

Note, This Character (÷) ſignifies *Diviſion*, or that the Number is divided by what follows it.

2. Divide £47 $\frac{1}{2}$ of $\frac{2}{3}$ by $\frac{2}{3}$ of $\frac{3}{5}$ of a £. *Anſ.* $\frac{4260}{36}$. For $\frac{1}{2}$ of $\frac{2}{3} = \frac{2}{6}$, and $\frac{2}{3}$ of $\frac{3}{5} = \frac{6}{15}$; therefore, divide £47 $\frac{2}{6}$ by $\frac{6}{15}$, that is, divide $\frac{284}{6}$ by $\frac{6}{15}$. Firſt, $284 \times 15 = 4260$ *N N.* and $6 \times 6 = 36$ *N D.* *Anſ.* $\frac{4260}{36}$, or £118 $\frac{12}{36}$ = 6*s.* 8*d.*

Tyro. Then I perceive that *Diviſion* of Fractions makes more of a Sum after divided than before.

Philo. Yes certainly, when the *Diviſor* is a *Simple* Fraction, or leſs than Unity, as in this Caſe; and it anſwers the ſame End as common *Multiplication*, *viz.* increaſes the Value.

Tyro. Explain this a little more, pray?

Philo. Obſerve then the following Example.

3. It is required to bring 42 Guineas into Farthings by *Diviſion* only?

Here by *Caſe* 4, I reduce a Farthing to the Fraction of a Guinea, and find it $\frac{1}{1008}$ for a *Diviſor*. Then I make 42 Guineas a *Dividend*, thus, $\frac{42}{1}$. Now, $\frac{42}{1} \div \frac{1}{1008} = 42336$ Farthings.

☞ From hence, *Tyro*, ariſes this Obſervation, That where any *Whole Number* is divided by a *Simple* Fraction, the Quotient will be ſo much *larger* than the Dividend, as the Diviſor is *leſs* than the Unity, or 1; but on the contrary, when a *Simple* Fraction is to be divided by a *Whole Number*, then the Quotient will be ſo many Times *leſs* than the Dividend, as the Diviſor exceeds Unity.

Thus £4 divided by $\frac{1}{4}$ of a £. is the ſame as to multiply it by £4, *viz.* £16: But $\frac{1}{4}$ divided by 4 is = 4 Shillings only *.

And now, *Tyro*, we are come to that Rule wherein all the others are exerciſed, *viz.*

SECTION VII.

The Rule of Three *in* Vulgar Fractions.

Tyro. HOW is this Rule performed?

Philo. After having reduced *Compound Fractions* and *Mixt Numbers*, as before directed, Firſt, (as in the common *Rule of Three*) make your *firſt* and *third*

---

* See more of the Nature of *Vulgar Fractions* in my *Young Algebraiſt's Companion*, Dialogue 3, Caſe 3, 4.

Number of one Name; then multiply your *ſecond* by your *third*, and divide by your *firſt*.

Or rather thus:

Having ſtated the Queſtion, and reduced the Fractions, multiply the Denominator of the *firſt* Number into the Numerator of the *ſecond* and *third* Numbers, for a new Numerator, and the Numerator of the *firſt* Number into the Denominator of the *ſecond* and *third*, for a new Denominator, and that is your Anſwer required.

1. If $\frac{3}{4}$ of a Yard coſt $\frac{5}{6}$ of a £. what coſt $51\frac{1}{4}$ Yards?

$$\begin{array}{r}4\\\hline 205\\\hline 4\end{array}$$

Thus, $\frac{3}{4}$ $\frac{5}{6}$ $\frac{205}{4}$. Now I begin with the Denominator of the *firſt* Fraction, thus, 4×5×205=4100 *N. N.* And 3×6×4=72 *N. D.* So is the Anſwer $\frac{4100}{72}$ of a £=£56 18*s.* 10*d.* $\frac{1}{2}$ $\frac{24}{72}$.

2. If a Load of Wheat coſt £15 $\frac{2}{12}$, what coſt one Buſhel?

Here, as 40 Buſhels make 1 Load, my *firſt* Number will be $\frac{40}{1}$ the *ſecond* Number reduced to an *Improper* Fraction is $\frac{182}{12}$, and 1 Buſhel will be $\frac{1}{1}$. Then, if $\frac{40}{1}$ be $\frac{182}{12}$ what $\frac{1}{1}$. Now 1×182×1=182 *N. N.* and 40×12×1=480 *N. D.* *Anſ.* $\frac{182}{480}$, which is=7*s.* 7*d.*

Tyro. This is eaſy enough, if this be a general Rule.

Philo. It is, and if you look over what has been done, you may with Eaſe do any Thing in this Rule; therefore, I ſhall only ſet you a few Queſtions for Practice.

3. What is the Intereſt of £219 $\frac{2}{3}$ for one Year, at £5 $\frac{3}{8}$ *per Cent.* *Anſ.* $\frac{28337}{2400}$, *viz.* £11. 16*s.* 1*d.* $\frac{1}{2}$ $\frac{1920}{2400}=\frac{4}{5}$.

4. Bought South-Sea Stock to the Value of £420 13*s.* 4*d.* and gave £95 $\frac{4}{5}$ *per Cent.* what comes it to? *Anſ.* £402. 19*s.* 11*d.* $\frac{1}{2}$ $\frac{108}{150}=\frac{18}{25}$.

5. A Perſon left 40 Shillings to 4 poor Widows, *A*, *B*, *C*, and *D*. To *A* he left $\frac{1}{3}$, to *B* $\frac{1}{4}$, to *C* $\frac{1}{5}$, and to *D* $\frac{1}{6}$, deſiring the Whole might be diſtributed accordingly; I demand the proper Share of each?

Take $\frac{1}{3}$, $\frac{1}{4}$, *&c.* of 40 Shillings, and add them together, it makes but 38 Shillings: Then ſay,

If 38*s.* be $\frac{1}{3}$, *viz.* 13*s.* 4*d.* what will 40 be? Thus proceed with all their Shares, you will find *A* muſt have 14*s.* 0*d.* $\frac{16}{38}$, *B* 10*s.* 6*d.* $\frac{12}{38}$. *C* 8*s.* 5*d.* $\frac{2}{38}$, and *D* 7*s.* 0*d.* $\frac{8}{38}$.

And now, *Tyro*, we will proceed, to

DIALOGUE. XIII.

SECTION I.

NOTATION *of* DECIMAL FRACTIONS.

Tyro. WHAT do you mean by a *Decimal?*

Philo. Any Number, whether with Cyphers before it or not, having a Dot before them, thus, .2 .005 or .4715 &c. are *Decimals.*

Tyro. How are theſe *Decimals* formed?

Philo. Every *Decimal* is a *Vulgar Fraction*, having as many Cyphers for its Denominator, and an Unit beſides.

ſides. Thus the foregoing *Decimals* expreſſed in *Vulgar Fractions* are $\frac{2}{10}$, $\frac{005}{1000}$, and $\frac{4725}{10000}$, &c. but the Denominators are caſt away in *Decimals*, becauſe you ſee they are always known, and we work only with the Numerator, or the *Decimal* itſelf; and this is the Reaſon that *Decimal Fractions* are ſo very eaſy to what *Vulgar* are.

Tyro. I underſtand you; but have you no *Mixt* Numbers here as well as in *Vulgar Fractions?*

Philo. Yes: A *whole* Number, and a *Decimal* after it, is a *Mixt* Number. Thus, 47 .5 or 5 .25 are *Mixt* Numbers, ſignifying 47 *whole Numbers*, and $\frac{5}{10}$th Parts or $\frac{1}{2}$; and the other is 5 *whole Numbers*, and .25 hundredth Parts, or 1 Quarter, for 25 is $\frac{1}{4}$ of 100.

Note 1. Cyphers after Figures are of no Signification in *Decimals*, thus, .500 is but .5 and .750000 is but .75 for .500 is $\frac{500}{1000}$, which is the ſame as $\frac{5}{10}$: But Cyphers before *Decimals* are neceſſary, for they decreaſe their Value. Thus, .5 is 5 tenth Parts, or $\frac{1}{2}$, but .05 is but 5, one hundredth Part, *&c.*

Note 2. Pray remember this: That .5 ſignifies the *Half* of any *whole* Number, Thing, or Integer. .25 is *one Quarter*, and .75 ſignifies *three Quarters*. For .5 is $\frac{1}{2}$ of 10, .25 is $\frac{1}{4}$ of 100, and .75 is $\frac{3}{4}$ of 100.

This being will underſtood, you may proceed to *Addition*.

SECTION II.

ADDITION *of* DECIMALS.

Tyro. HOW is *Addition* of *Decimals* performed?

Philo. The ſame as common *Addition*, only with this Difference, that you muſt ſet Tenths under Tenths, and hundred Parts under hundred Parts, not regarding the Number of *Decimal* Places, but ſet them all even towards the firſt Left-hand Row, that ſtand next the *whole* Numbers, and then add them all together as in *Whole Numbers*.

One Example well explained will be ſufficient, for you will ſee the Reaſon more plainly in *Reduction*.

1. Add £47.45 .7259 £5.25 .000545 and 15.5 together

```
      47.45
        .7259
       5.25
        .000545
      15.5
      ─────────
Anſ.  68.926445
```

Here you ſee I place the *Whole Numbers* under one another, as in *Addition*, and the *Decimals* I place even next the *Whole Numbers*, not regarding how far they extend to the Right-hand: Then I add them as they ſtand, like *Whole Numbers*.

2. Add .5 .75 .005 .0005 .95 and .3 together. *Anſ* 2.5055. If you ſet theſe under one another, and add them as before, you will have 2 *whole* Numbers, and .5055

Note, Always remember to part the *Decimals* from the *whole* Numbers by a Dot. Thus, I find in caſting up this laſt Sum it amounts to 5 Figures; but as there are but 4 Figures in the largeſt *Decimal*, therefore, I make a Dot between the 4th and 5th Figure, always keeping an equal Number of *Decimal* Places.

SECTION III.

SUBTRACTION *of* DECIMALS.

Tyro. IF *Addition of Decimals* be performed like *Whole Numbers*, I imagine *Subtraction* is the ſame.

Philo. It is ſo, only place the Figures to the Left hand, always under one another, let them be Cyphers or Figures; but don't regard Cyphers to the Right. An Example will make it quite eaſy.

From	47.0075	From	.7	From	5.25
Take	15.51	Take	.275	Take	.98407
Anſ.	31.4975	*Anſ.*	.425	*Anſ.*	4.31593
Proof	47.0075	Proof	.7	Proof	5.25

Here you ſee I do by *Tens*, as in *Whole Numbers*, and borrow and carry the ſame, only I never ſet down Cyphers to the Right-hand of the Figures, but entirely diſcard them.

2. Borrowed 100 Guineas, and paid at three ſeveral Times, each £27.275 what is to pay? *Anſ.* £23.175 or £23. 3*ſ*. 6*d*.

SECTION IV.

MULTIPLICATION *of* DECIMALS.

Tyro. HOW is *Multiplication* performed?

Philo. Like common *Multiplication*, having no Regard at all to the *Decimals* till the Work is done, and added up: Then count how many *Decimal* Places you have both in the *Multiplicand* and *Multiplier*, and as many *Decimals* as you find in both theſe; ſo many Figures you are to prick, or point off from the Right-hand to the Left: So will the Figures on the Left-hand of the Dot be *whole* Numbers, and thoſe towards the Left, *Deeimal* Parts.

EXAMPLES.

Multiply	7.256	Multiply	.5759
by	.762	by	.0375
	14512		28795
	43536		40313
	50792		*17277
Anſ.	5.529072	*Anſ.*	.02159625

Here in *Example* 1, I have 6 *Decimals* in the *Multiplicand* and *Multiplier*; therefore, I prick, or dot off 6 towards the Left hand, and have 5 for a *whole* Number, and all the reſt are *Decimals.*

* *Note,* In *Example* 2, I have 8 *Decimals* in the *Multiplicand* and *Multiplier*; but I find upon caſting them up, that there are but 7 Places of *Decimals*, therefore, I place a Cypher before the firſt Figure, and make a Dot before the Cypher; ſo I have 8 *Decimals.*

This is a ſtanding Rule; for had the Product been leſs in the Number by 2, 3, or more Places, ſo many Cyphers muſt have been added to ſupply the Deficiency.

Tyro. This is eaſy enough, as you obſerved, to what *Vulgar Fractions* are: And I perceive that *Money*, *Weight*, or *Meaſure*, may be eaſily multiplied by this Rule.

Philo. You ſay right: For, ſuppoſe I was to multiply £4.15*s*. by £3.10*s*. it would produce £16. 12*s*. 6*d*. For £4.15*s*. is 4.75 (becauſe 15*s*. is $\frac{3}{4}$ of a £.) and £3.10 is £3.5. Therefore, £4.75×3.5=£16.625, or 12*s*. 6*d*.

3. Multiply .000075 by .0015. *Anſ.* .0000001125.

4. Multiply $4\frac{1}{2}$, *viz.* 4.5. by 4.5. *Anſ.* 20.25, or $20\frac{1}{4}$.

5. Multiply $\frac{1}{2}$ a Crown by $\frac{1}{2}$ a Crown. *Anſ.* 6.25, or 6*s*. 3*d*.

See *Multiplication of Vulgar Fractions*; and more of the Nature of this, with the Way and Manner of valuing any *Decimal*, in *Reduction of Decimals*.

SECTION II.

DIVISION of DECIMALS.

Tyro. HOW is *Diviſion* performed?

Philo. The ſame as common *Diviſion*; but being a little more difficult than the other Rules, you muſt be the more careful: But if you obſerve the three following Notes, they will help you to work any Sum.

Note 1. When there are more *Decimal* Places in the *Dividend* than in the *Diviſor*, then (after the Work is done) prick off as many in the Quotient to ſupply that Defect; that is, the *Decimals*, Places of the *Diviſor*, and the *Quotient* muſt always be equal to thoſe in the *Dividend*.

Note 2. If there be more *Decimal* Places in the *Diviſor* than in the *Dividend*, (before you begin to work) add as many Cyphers to the *Dividend* as makes the Number of *Decimal* Places equal to the *Diviſor*, and proceed as before directed.

Note 3. When it happens that the *Decimal* Places in the *Diviſor*, and *Quotient* (after the Work is done) are not ſo many as thoſe of the *Dividend*; then you muſt place as many Cyphers before the Quotient, or Anſwer, as will make up that Deficiency.

.5)47.3476	.12)63.00	12.).063
Anſ. 94.625	*Anſ.* 5.25	*Anſ.* .005
See Note 1.	*See Note* 2.	*See Note* 3.

☞ Remember that all Remainders in *Decimals* after *Diviſion* are of no Signification, and therefore are taken no Notice of.

The ſame is to be obſerved in long *Diviſion* as in the three foregoing Examples in Relation of pointing off

471.5)3.747565(.0794 *Anſ.*
3.3005

44706
42435

22715
18860

But if thus.

.4715)3.747565(7.94 *Anſ.*

Here you ſee the ſame Sum is propoſed, but the Anſwer is different, as you may prove at large; for the Figures will be the ſame. And thus you ſee, let them be *whole* or *mixt* Numbers, the Work is the ſame.

Tyro. I underſtand it: And I perceive it is very eaſy to divide Money into any Number of Parts by this Rule.

Philo. Very eaſy indeed.

6. Divide £42 19*s*. 6*d*. by £4 15*s*. 6*d*. That is, divide £42.975 by £4.775. *Anſ*. £9.

7. Divide £4 5 (*viz*. £4 10*s*.) by £3.5 (*viz*. £3. 10*s*.) *Anſ*. £1.285, or £1. 5*s*. 8*d*. ¼.

8. Divide 1.753 by £1753. *Anſ*. 001.

This Example, tho' it appears trifling at firſt, may be of Service. For ſuppoſe it was reduced to Money, thus, It is required to divide £1. 15*s*. and 3 Farthings (which is nearly £1.753) among 1753 Perſons. *Anſ*. 001, as before, which is 1 Farthing each. Thus may you vary or alter *Decimals* at Pleaſure; but as for Money, and the Manner of finding its Value in any *Decimal Fraction*, that you will ſee in the next *Section*, which if you obſerve well, you will ſee the whole Order of *Decimals*, and their Relation, and Harmony, compared with *Vulgar Fractions*.

SECTION VI.

REDUCTION *of* DECIMALS.

Tyro. WHAT does *Reduction of Decimals* teach?

Philo. It teaches to reduce a *Vulgar Fraction* to a *Decimal* of the ſame Value, and alſo ſhews you how to find that Value, either in *Money*, *Weight*, or *Meaſure*, &c.

CASE 1.

To reduce a Vulgar Fraction *to a* Decimal.

Add as many Cyphers as you pleaſe to the Numerator, (making a Dot between the Numerator and the Cyphers) then divide by the Denominator, as in common *Diviſion*, and making a Dot before the Figures in the Quotient, you have the *Decimal* equal to to the *Vulgar Fraction*.

1. Reduce $\frac{3}{4}$ to a *Decimal*. *Anſ.* .75.

4)3.00
——
.75

Here you ſee .75 is $=\frac{3}{4}$, for .75 is $\frac{3}{4}$ of 100, its proper Denominator.

2. Reduce $\frac{5}{8}$ to a *Decimal* of the ſame Value.

8)5.000
——
.625 *Anſ.*

That is, .625 is $\frac{5}{8}$ of 1000, its Denominator.

3. Reduce $\frac{5}{395}$ to a *Decimal*. *Anſ.* .01265.

4. Reduce $\frac{3}{1758}$ to a *Decimal*. *Anſ.* .00171.

Note, Sometimes in reducing a *Decimal* there will always be a Remainder; but never regard that, if you have 5 Places in a *Decimal* it is ſufficient.

CASE 2.

To reduce the known Parts of Money, Weight, *or* Meaſure *to a* Decimal.

Add Cyphers to the loweſt Denomination (making a Dot between the Cyphers and the Figure) and divide by the Parts contained in the next higher Denomination; then place the next higher Denomination before that Quotient (with a Dot between) and divide by the Parts contained in the next higher Denomination; and ſo go on, and your laſt Quotient will be the *Decimal* required.

But this muſt be illuſtrated by an Example to make it plain.

1. What is the Decimal of 14*s.* 6*d.* ¾?

```
    4) 3.00000
       -------
   12) 6.75000
       -------
  2|0)14.56250
       -------
      .728125  Anſ.
```

Here, according to the Rule, I add Cyphers to the loweſt Denomination, 3 Farthings, and divide by 4; then I place the 6 Pence before that Quotient, and divide by 12. *Laſtly*, I place 14 Shillings before this laſt Quotient, and divide by 20, (*viz.* by 2) without cutting any Figure or Cypher off to the Right-hand; for there is no Occaſion for that.

See the Proof of this in *Example* 1, next *Caſe*.

2. What is the *Decimal* of 18*s.* 9*d.* ½? *Anſ.* .93958

Note 1. If you would know the Decimal of any Number of Shillings, from 1 to 19, obſerve this general Rule: If the Shillings be even, take the ½ of them is the Decimal. Thus, the Decimal of 16*s.* is .8, and of 18*s.* is 9, &*c.* But if the Shillings be odd, multiply them by 5, gives the Decimal. Thus, the Decimal of 5*s.* is .25; for 5 Shillings is ¼ of a £, and .25 is ¼ of 100. So alſo, the Decimal of 17*s.* is .85, and 11*s.* is 55, and the Decimal of 1*s.* is .05; for there muſt be 2 Places, when the Shillings are odd.

A RULE *to find the* Decimal *of Shillings, Pence, and Farthings, at a £. Sterling, the Integer at once.*

1. For *Shillings*. Add Cyphers to the Shillings, and divide by 20.

2. For the *Pence*. Add Cyphers to the given Pence, and divide by 240, the Pence in a £. pricking off according to the Rule of *Diviſion*. Thus you will find the Decimal of 6*d.* .025 and of 3*d.* .0125

3. For *Farthings*. Add Cyphers, and divide by 960: Thus the Decimal of 3 Farthings is .003125

Note, The ſame is to be obſerved in finding the Decimal of Weight and Meaſure, by adding Cyphers to the given Denomination, and dividing by the Parts contained in the Integer.

To tell the Decimal *of* Shillings, Pence, *and* Farthings, *by Inſpection.*

Note, If the Shillings be even, take the $\frac{1}{2}$ of them, which will be the firſt Decimal Figure; then bring the Pence and Farthings into Farthings, and if they be leſs than 5, join them to the firſt Decimal Figure, ſo have you a Decimal of 3 Places; but if the Farthings be more than 5, ſet down 1 more than they really are; if they be above 40, ſet down 2 more than they amount to; ſo have you the Decimal nearly.

1. Let it be required to find the Decimal of 14*s*. 6*d*. $\frac{3}{4}$, and 18*s*. 9*d*. $\frac{1}{2}$, as before. Here I ſay the $\frac{1}{2}$ of 14 is .7, the firſt Figure; then 6*d*. $\frac{3}{4}$ is 27 Farthings, but being above 5, I ſet down 28 Farthings by the Side of the 7, ſo is the Decimal .728, as before; and ſo for the other.

2. What is the Decimal 6*s*. 10*d*. $\frac{1}{2}$? *Anſ*. .344
Here the $\frac{1}{2}$ of 6*s*. is 3, and 10*d*. $\frac{1}{2}$ is 42 Farthings, but being above 40, I, by the Rule, ſet down 2 more, *viz*. 44; ſo is the Decimal .344 nearly.

Note, When the Shillings are odd, multiply them by 5, and bring the Pence and Farthings into Farthings, as before, and ſet the firſt Figure under the ſecond Figure of the Decimal belonging to the Shillings, encreaſing them by 1, or 2, as before, you have the Decimal.

3. What is the Decimal of 17*s.* and 6*d.* ¾: And 11*s.* 10*d.* ¾?

17 multiplied by 5 is .85	11×5=.55
6¾ more 1 Farthing 28	10*d.*¾+2=45
Anſ. .878	.595

The next *Caſe* is a Proof to this, and more uſeful.

CASE 3.

To find the Value of a Decimal *in* Money, Weight, *and* Meaſure.

Multiply the Decimal by the Parts contained in the Integer, and prick off as many Figures as there are Places in the given Decimal, and the Figures towards the Left-hand will be Whole Numbers, and thoſe that are pricked off are Decimals, which Decimals only muſt be multiplied by the next Denomination: Thus go on, multiplying and pricking off the ſame Number of Decimals; ſo will the Figures towards the Left-hand be the Value required.

1. What is the .728125 of a £. Sterling?

.728125
20
s. 14.562500
12
d. 6.7500
4
qrs. 3 00

Anſ. 14*s.* 6*d.* ¾. See *Ex.* 1 of laſt *Caſe.*

2. What is the .7615 of a Guinea?

21
7615
15230
s. 15.9915
12
d. 11.8980
4
qrs. 3.5920

Anſ. 15*s.* 11*d.* ¾

3. What is the .1756 of a Ton?
20
C.3.5120
4
qrs.2.0480
28
3840
0960
lb.1.3440
16
oz.5.5040

Anſ. 3 C. 2 *qrs*. 1 *lb*. 5 *oz*.

4. What is the .09715 of a Bar.
36
58290
29145
Gall. 3.49740
8
Pints 3.97920

Anſ. 3 *Gall*. 3 *Pints* and $\frac{9}{10}$, or very near $3\frac{1}{2}$ *Gall*.

To tell the Value of any Decimal *in* Shillings, Pence, *and* Farthings, *(by Inſpection only) at a £. Sterling the Integer*.

Note, If there be ever ſo many Places in the *Decimal*, the firſt 3 Figures are ſufficient, and all that are required in Buſineſs.

Note 2. Double the firſt Decimal Place towards the Left-hand, and if the ſecond Figure be under 5, then the firſt Figure doubled will be the *Shillings*; but if the the ſecond Figure be 5, or above 5, then you muſt add 1 Shilling more to thoſe you doubled; and what remains over the 5, carry to the next Figure, placing it before it in your Mind, and thoſe will be the Farthings, which, if under 5, ſet down what they amount to; if above 5, not exceeding 40, then abate or ſet down 1 Farthing leſs than they are; and if above 40, ſet down

2 more than they really are, and you have the Value required.

1. What is the Value of .728125 of a £? *Anſ.* 14*s.* 6*d.* $\frac{3}{4}$.

Here I double the firſt Figure 7, which is 14 for the Shillings, and then I ſay, 28 Farthings is 7*d.* but I abate 1, becauſe it is above 5; ſo it is 14*s.* and 6*d.* $\frac{3}{4}$.

2. What is the .39525 of a £. *Anſ.* 7*s.* 10*d.* $\frac{3}{4}$.

Here I ſay, twice 3 is 6, and the next Figure being above 5, I count 1 more, which is 7 Shillings; then there is 4 remains from the 9, which I carry to the 5, which is 45 Farthings; but being above 40, I abate 2, and call it 43 Farthings, which is 10*d.* $\frac{3}{4}$.

3. What is the .0672 of a £. Sterling? *Anſ.* 1*s.* 4*d.*

Here the Cypher doubled is 0; but the ſecond Figure being 6, that is 1 Shilling and 1 over, which I carry to the 7, is 17 Farthings, and abating 1 Farthing is 16, or 4 Pence; which you may prove by multiplying the Decimal by 20, 12, and 4, pricking off, as before directed.

EXAMPLES *for Exerciſe.*

4. What is the .8145 of a Ton? *Anſ.* 16 *C.* 1 *qr.* 4 *lb.* 7 *oz.* 10 *d.* .88

5. What is the .275 of a *lb. Troy*? *Anſ.* 3 *oz.* 6 *dwts.*

6. What is the .0729 of a Year, at 365 Days, the Integer? *Anſ.* 26 Days, 12 Hours, 12 Minutes, 14 Seconds.

Theſe Examples are ſufficient for any diligent Learner, therefore, I will proceed to put them all in Practice.

SECTION VII.

The Rule of Three Direct *in* DECIMAL FRACTIONS.

Tyro. HOW is the *Rule of Three* in *Decimals* performed?

Philo. The ſame as the common *Rule of Three Direct*, by multiplying the *ſecond* Number by the *third*, and dividing by the *firſt*.

1. If $\frac{3}{4}$ of a Yard coſt $\frac{5}{6}$ of a £. what coſt 51 $\frac{1}{4}$ Yards? That is, If 3 *qrs.* coſt 16*s.* 8*d.* what coſt 51 Yards, 1 *qr.*

Decimally thus,

If .75 be 8.333 what is 51 .25 Yards?

Here multiply your *ſecond* by the *third*, and divide by the *firſt*, you have the Quotient 56.942 *viz.* £56 18*s.* 10*d.*

See *Example* 1, *Rule of Three of Vulgar Fractions.*

2. If a Buſhel of Wheat coſt 3*s.* 9*d.* $\frac{1}{2}$, what coſt 40 Buſhels, or 1 Load? *Anſ.* £7. 11*s.* 8*d.*

Decimally thus,

If a Buſhel of Wheat coſt 1.8958, what coſt 40?
40

£7.58320 *Anſ.* £7 11*s.* 8*d.*

Tyro. This laſt Example is very ſhort indeed.

Philo. It will always be ſo when the *firſt* Number is 1, or Unity; for *Decimals* are ſuperior to *Vulgar Fractions*, for Eaſe and Expedition; and though not always ſo near the Truth itſelf, yet anſwers every Thing near enough for any Buſineſs, or Demand. See the next Queſtion in *Variations*.

3. If 5¼ Ells coſt £2 $\frac{803}{960}$ of a £. what coſt 282½ Ells? That is, If 5¼ coſt £2 16*s*. 8*d*. ¾, what coſt 282½ Ells?

Decimally thus,

If 5.25 Ells coſt £2.8364, what coſt 282.5 Ells? *Anſ*. £152 625 *viz*. £152 12*s*. 6*d*.

4. If 1 Ton of Sweet Oil coſt £24.17.4½, what coſt 14 *T*. 17 *C*. 2 *qr*. 19 *lb*. *Anſ*. £370.1335, or 2*s*. 8*d*. ½.

Now, *Tyro*, in all ſuch Sums as theſe, which either by the *Rule of Three*, *Practice*, or *Vulgar Fractions*, will become very tedious; yet, by finding the Decimal of the odd Weight, and the odd Price, you have only a common *Multiplication* Sum.

That is, multiply 14 Ton .88348 by £24.86875, you will have £370.1335 *viz*. 2*s*. 8*d*. *Anſ*.

Note, You may find the Decimal of 17 *C*. 2 *qrs*. 19*lb*. by bringing them into *lbs*. and dividing by the *lbs*. in a Ton, *viz*. 2240. The ſame for any other *Weight*, or *Meaſure*, by reducing the Parts, and dividing by the Parts contained in the Integer.

DIALOGUE XIV.

SECTION I.

SIMPLE INTEREST.

Tyro. HOW is *Simple Intereſt* in *Decimals* performed?

Philo. Very eaſily, by the following Rule. Multiply the Principal by the Rate *per Cent.* and prick off the Decimals, gives the Intereſt for one Year; and if there be odd Time, take the Parts of the Principal itſelf, and add to the Work, it is done.

Note, For £4 *per Cent.* multiply by .04; for 5 *per Cent.* by .05; for 6 *per Cent.* .06; for 7 *per Cent.* .07

1. What is the Intereſt of £147. 15*s.* for a Year, at £4 *per Cent. per Annum*? *Anſ.* 147.75.

£147.75
.04
£5).9100
20
*s.*18) 20
12
*d.*2) 40
4
*q.*1|60

What is the Intereſt of 275.10 for 1 Year, at £6 *per Cent.*

£275.5
.06
£16.530

Anſ. £16. 10*s.* 7*d.* ¼.

O 5

And the Work will be as eaſy, if the *per Cent.* be for odd Time, as appears by the following Examples.

3. What is the Intereſt of £1250. 15*s.* for 3½ Years at 6 *per Cent. per Annum?*

	£1250.75 .06	
½	75.0450	for 1 Year
	3	
	225.1350	for 3 Years.
	37.5225	add
	262.6575	for 3½ Years. *Anſ.*

4. A Perſon left his Nephew by Will ⅓ of his Eſtate, which was £355. 7*s.* 6*d.* Now this lay in Hand 3½ Years; I demand what Intereſt is due upon it, at £4½ *per Cent. per Annum?*
Anſ. £55. 19*s.* 5*d.*

Multiply £355.375 by £4 ½, that is, by .045 is £15 .991875 for 1 Year: This multiplied by 3.5 Years gives £55.9715625

And thus you ſee that if the *Principal*, *Intereſt*, or *Time*, be ever ſo much, yet it is eaſily performed by *Decimals.*

5. A Merchant made an Aſſurance upon Goods in a Ship bound to a certain Port, to the Value of £2550, upon Condition, that in Caſe of a total Loſs, or Damage, the *Aſſurers* were to pay £97 ½ *per Cent.* deducting ½ *per Cent.* (*viz.* 10*s. per Cent.*) out of it: Now the Ship was caſt away, but there was as many Goods ſaved as amounted to £955; I demand what the Merchant has to receive? *Anſ.* £1527. 18*s.* 11*d.*

Firſt, £955 taken from £2550 remains £1575 Loſs. This multiplied by 97.5 is 1535.625: And deducting ½ *per Cent.* from this, is only cutting off 2 Figures in the Pounds, thus, 15|35, and take the ½ of 15|35.625, which is 7.678125 (placing it in the Units Place of the Pounds, and the reſt in Order, as follows, in *Diviſion*) and ſubtract it from £1535.625 leaves £1527.946875 *viz.* 18*s.* 11*d.* *Anſ.*

The Proof of this is worthy your Obſervation, *Tyro.*

For obſerve 97 ½ *per Cent.* wants but 2½ *per Cent.* of £100, that is, of being *Cent. per Cent.* Now if you multiply £1575 by 2.5 *viz.* (2½) it gives £39.375, which added to £1535.625, gives the original Sum, or Loſs, *viz.* £1575.

Tyro. I thank you kindly, Sir; for this, as you have obſerved, is a Proof to me very plainly.

6. What comes an Aſſurance, or a Commiſſion Factorage, or Brokerage to, upon £3500, at 18*s.* *per Cent.*

35|00

.9 The Decimal of 18*s.*

£31.5 *Anſ.* £31.10

And thus *Decimals* perform any Thing with Eaſe and Pleaſure.

Tyro. I ſee it, Sir; and now be pleaſed to give me an Example or two in *Compound Intereſt.*

Philo. I will.

SECTION II.

COMPOUND INTEREST.

Tyro. HOW is *Compound Intereſt* performed?

Philo. By continual *Multiplication* and *Addition.* Let us take the firſt Example in *Compound Intereſt*, page 248.

1. What will £100 amount to, if it be forborn 3 Years, at £5 *per Cent. per Annum, Compound Intereſt?* *Anſ.* £115-15s. 3*d.*

£100
.05

£5.00 Intereſt 1 Year, add this to the £100 is £105.

£105 Principal ſecond Year.
.05

£5.25 Intereſt the 2d Year, add this to £105 is £110 25

£110.25 Principal the third Year.
.05

£5.5125 Intereſt the third Year.

Firſt Principal — —	£100
Firſt Year's Intereſt —	5
Second Year's —	5.25
Third Year's — —	5.5125
Principal and Intereſt in all	£115.7625 *viz.* 15*s.* 3*d.*

Do you underſtand it?

Tyro. Yes, very well; for there is no Difficulty in this to what there is in finding out the Intereſt by the common Method in Page 248, as you obſerved.

Philo. Then I ſhall leave one Example (if you think worth while) for your Proof and Practice.

A lent *B* £136.775. which *B* promiſed to pay *Compound Intereſt* for, at £6 *per Cent. per Annum*, and bound his Heirs, Executors, *&c.* to that Condition: Now *A* died, and *B* took no Notice of Payment till it was at laſt diſcovered by the Executors of *A*, that *B* had had the Money in Hand 20 Years: I demand what *B* has got to remit for the Debt? *Anſ.* £438.6552

Note, As to *Annuities*, *Penſions*, *Reverſions*, &c. upon Eſtates, they are beſt found by Algebraic Calculations; and as this does not directly tend to the Deſign of this ſmall Treatiſe, I muſt beg Leave to omit them; eſpecially as there are many Tables calculated from 1 to 30 Years, which is a common Multiplier, for that Time any Sum is forborn. Theſe Tables are eaſily made, the Conſtruction depends, as I told you in *Simple Intereſt*, upon this: That let the *per Cent.* be what it will, ſuppoſe £4 *per Cent.* ſay, If £100 be £104, what will £1 be? *Anſ.* £1.04 for 1 Year. So alſo for 4 ½ *per Cent.* it is £1.045; for 5, it is 1.05, *&c.*

Tyro. I underſtand you very well, Sir, and ſhall endeavour, as Time offers itſelf conveniently, to look over theſe Things, and make myſelf yet more perfect.

Philo. You will perform your Promiſe, I hope; but before I leave you, I will give you a Notion of the Extraction of the *Square* and *Cube Roots*, being very neceſſary in many Buſineſſes; but eſpecially in the Art of Menſuration, and ſeveral other Branches of the Mathematics.

DIALOGUE XV.

SECTION I.

The Extraction of the SQUARE ROOT.

Tyro. WHAT do you mean by the Words *Square* and *Root?*

Philo. A *Square* Number is a Number multiplied by itſelf, *viz.* any Figure or Figures multiplied by the ſame Figure or Figures, the Product is the Square of that Number: Thus, 2×2=4, the Square of 2; and 9×9=81, the Square of 9.

Tyro. This is plain enough. And what is the *Root* then?

Philo. The *Root* is that from which the *Square* is formed: Thus, I told you before, the Square of 2 is 4, and the Square of 9 is 81; therefore, *vice verſa*, 2 is the *Root* of 4, and 9 is the *Root* of 81, as appears by the following *Table*, which ſhould be readily known.

TABLE.

Roots	1	2	3	4	5	6	7	8	9	10	11	12
Squares	1	4	9	16	25	36	49	64	81	100	121	144

Tyro. How is the *Square Root* extracted?

Philo. I will ſhew you the whole Proceſs, which pray obſerve.

Suppoſe it were required to extract the *Square Root* of 3136, or any other Figures.

Firſt, I ſet down the Figures thus, $\dot{3}1\dot{3}6$, and beginning at the Units Place, I make a Dot or Point over it, and alſo over every other Figure towards the Left-hand, as you ſee in the Margin; and pray obſerve, that as many Dots as you have, ſo many Figures the Root will always conſiſt of, which here are 2.

Secondly, I ſeek (by the *Table*) the neareſt Root to the Figures contained in the firſt Point of Figures, *viz.* in 31, and find it to be 5, which I place in the Quotient thus, $\dot{3}1\dot{3}6(5$, which Figure 5 is called the *Root*, or Part of the Root.

Thirdly, Square the Root, that is, multiply it by itſelf, and place it under the ſaid firſt Point, as in common *Diviſion*, and ſubtract it therefrom, and bring down the next Point, *viz.* 36, and place it by the Side of the Remainder, it is 636, which is called the *Reſolvend*, as in the Margin.

$$\begin{array}{l} \dot{3}1\dot{3}6(5 \\ \underline{25} \\ 636 \text{ \textit{Reſolvend}.} \end{array}$$

Fourthly, Then I double the Quotient Figure, or Root 5, which is 10, and making another crooked Line, I place it for a *Diviſor* right againſt the *Reſolvend*, thus,

$$\begin{array}{rl} & \dot{3}1\dot{3}6(5 \\ & \underline{25} \\ \text{\textit{Diviſor} } 10) & 636 \text{ \textit{Reſolvend}} \end{array}$$

Fifthly, I now aſk, (as in *Diviſion*) how many Times 10 I can have in the *Reſolvend* (always rejecting the laſt Figure) that is, how many Times 10 are contained in 63, and find it 6 Times, which 6 I put in the Root by the Side of the 5, and alſo by the Side of the *Diviſor* 10, which makes 106; then I multiply 106 by 6, which is 636, and nothing remains: Thus I find the Square Root of 3136 to be 56.

$$\begin{array}{rl} & \dot{3}1\dot{3}6(56 \text{ Root. \textit{Anſ.}} \\ & \underline{25} \\ 106) & 636 \\ & 636 \end{array}$$

PROOF.

I ſquare the Root 56, that is, I multiply it by itſelf, *viz.* 56 by 56, and it gives 3136.

2. What is the Square Root of 56169?

```
   56169(237 Root.  Anſ.
   4
   ———
43)161 Reſolvend
   129
   ———
467) 3269 New Reſolvend
     3269
     ———
       0
```

Here I proceed the ſame as in *Example* 1, by making a Dot over every other Figure, and find the neareſt Root of the firſt Point 5 to be 2, which I ſquare, and place under 5, and remains 1, to which I bring down the next two Figures 61, and it is 161; then I double the Root 2, it is 4, which I place on the Left-hand for a Diviſor. Then I aſk how many Times 4 are contained in 16, which, tho' it be 4, yet upon Trial will be but 3 Times (for you muſt obſerve, it will often be leſs than it looks to be) which 3 I place in the Quotient, and alſo by the Side of the Diviſor 4, which makes it 43; then I multiply 43 by 3, and it is 129; and ſubtracting 129 from 161, I have 32 remains, to which I bring down the next Point, or two Figures 69, and it is 3269, which I call a *New Reſolvend*; then I double the Root 23, which is 46, for a *New Diviſor*, and aſk how many Times 46 I can have in 326, and find it 7, which I place in the Quotient, and alſo after 46, and it is 467; which multiplied by 7, gives 3269. Thus I find the *Square Root* of 56169 to be 237. And for a *Proof* I find 237 multiplied by 237=56169. Do you underſtand it, *Tyro?*

Tyro. Very well, Sir: Then I perceive that after I have done with the firſt Figure in the Root, I am to double it, and take down the next Point, and then double the two Figures, and take down the next Point, and ſo keep on in the ſame Order: Am I not?

Philo. Your Notion is right, and if you conſider well the Manner of the working the laſt Example, if you have ever ſo many Figures you may do it with Eaſe.

Tyro. But ſuppoſe after the Work there ſhould be a Remainder?

Philo. That matters not at all; only when you come to prove the Work, after multiplying the Root by itſelf, you muſt add the Remainder to the Product, and it will be equal to the given Number, if the Work be right.

Sums for Practice.

3. I demand the *Square Root* of 2996361. *Anſ.* 1731.

4. I demand the *Square Root* of 3076516. *Anſ.* 1754.

5. What is the *Square Root* of 43623. *Anſ.* 208, and 359 remains over.

N. B. If you have a Mind at any Time to know what the Remainder will produce, add an even Number of Cyphers to the Sum, and double the Root, and proceed as before: Thus, the Square Root of 43623.000000 is 208.861.

2. To extract the *Square Root* of a *Vulgar Fraction.* Extract the Square Root of the Numerator for a new Numerator, and of the Denominator for a new Denominator.

6. What is the Square Root of $\frac{25}{81}$. *Anſ.* $\frac{5}{9}$.

Note, When you can't extract the Root of the Numerator and Denominator, then reduce the *Vulgar Fraction* to a *Decimal,* you have the Anſwer.

7. What is the Square Root of 1 and $\frac{3}{5}$?
Firſt, $\frac{3}{5}$ is=.6, which is 1.6; then I add Cyphers, thus, 1.60000, and find the Root to be 1.264.

Note, There muſt be always an equal Number of Decimals.

8. What is the Square Root of 19.2 *Anſ.* 4.3817

9. What is the Square Root of .0003 *Anſ.* .01732

SECTION II.

The Uſe of the Square Root *applied to various Branches of the Mathematics.*

10. I Demand what is the mean proportional Number between 40 and 50. *Anſ.* 38. 7 Tenths.
Multiply one Number by the other, and add Cyphers, and extract the Square Root, you have 38.7

11. There is a Triangle, whoſe Baſe is 30 Inches, and the Perpendicular 40; I demand the Hypothenuſe? *Anſ.* 50.

Note, The *Perpendicular* is that Part which is right up; the *Baſe* is that which lies next you, and the *Hypothenuſe* is the ſlanting Side, called alſo the Diagonal Line.

A General RULE *to find the third Side of any Triangle, having two Sides given.*

1. Having the *Perpendicular* 40, and *Baſe* 30, as above, to find the *Hypothenuſe*, add the Square of the *Baſe* and *Perpendicular* together, and extract the Square Root of

them, you have the *Hypothenuſe.* Thus the Square of 30=900 The Square of 40=1600, their Sum is 2500, the Square Root of which is 50, the *Hypothenuſe* required.

2. Having the *Hypothenuſe* and *Perpendicular*, or *Baſe* given to find the other Side.

From the Square of the *Hypothenuſe* take the Square of the *Baſe*, or *Perpendicular*, and the Square Root is the other Side required.

EXAMPLE.

12. There is a Steeple to whoſe Vane or Top a String is tied, which reaching to the Ground, is in Length 60 Yards, and the Diſtance from where it touches the Ground to the Middle of the Steeple End is 25 Yards; I demand the Height of the Steeple? *Anſ.* 54.5 Yards.

Square 60 is 3600, and take the Square of 25, *viz.* 625 from it, and extract the Square Root, you have 54.5.

13. Suppoſe a Ship ſails from a certain Port, has made 87 Miles Difference of Latitude, and 71 Miles Departure, what is her Diſtance on a regular Courſe? This is only finding the *Hypothenuſe*; for add the Square of 87 and 71 together, and extract the Square Root, you have 112.2 Miles Diſtance.

14. There is a Circle or Triangle, whoſe ſuperficial Content is 30800.25, I demand the Side of a Square, whoſe ſuperficial Content ſhall be equal thereto? *Anſ.* 175.5.

15. Suppoſe a Rope 5 Inches round, I demand the Compaſs of another Rope, that is double the Strength? Square the Compaſs of the Rope, it is 25, which multiply by 2, and extract the Square Root, it is 7.07 Inches. If it were required to be 3, 4, 5, or 6 Times the Strength, then multiply the Square by 6, and extract the Root.

16. There is a Cable 10 Inches round, which weighs 21 *C*. I demand the Weight of one 8 Inches round. *Anſ.* 13.44. *C*.

As the Square of the one, *viz.* 100, is to the Square of the other, *viz.* 64, ſo is the Weight of the one to the other, *viz.* 13.44 *C*.

17. There is a Circle whoſe Content is 133.9385, I demand its Diameter?

Firſt, as 22 is to 28 :: 153.9385 to the Square of the Diameter, *viz.* 195 .9217 whoſe Square Root is 13.99

And thus I think I have given you ſufficient Examples in this Rule, that you may with a little more Practice become quite Maſter of it.

Tyro. I thank you for your Care, Sir, and I underſtand it very well; I wiſh I underſtood the *Cube Root* as well.

Philo. That you may ſoon do by Care, and a little more Pains, tho' it be ſomething more difficult than this Rule.

DIALOGUE. XVI.

SECTION I.

The Extraction of the CUBE ROOT.

Tyro. WHAT do you mean by a *Cube?*

Philo. A *Cube* is *that* which has *Length, Breadth*, and *Thickneſs*. Thus, ſuppoſe a Piece of Wood to be cut into the Form of a Dye (or *Dice*) which is equal every Way in *Length, Breadth*, and *Thickneſs*, ſuch a Figure is called a Solid, and by Name a *Cube*.

Tyro. Give me a further Deſcription of a *Cube* in Figures.

Philo. You know any Number multiplied by itſelf is a Square; ſo any Number multiplied twice into itſelf is a *Cube* Number: Thus, the *Cube* of 2 is 8: For 2×2 is 4, and 4×2=8: So alſo, the *Cube* of 5 is 125: For 5×5×5=125. Thus you ſee 8 is the *Cube*, and 2 the *Root* of that *Cube*. Alſo, 125 is a *Cube* Number, whoſe *Root* is 5, as appears by the following *Table* of both *Squares* and *Cubes*.

TABLE

Roots	1.	2.	3.	4.	5.	6.	7.	8.	9.
Squares.	1.	4.	9.	16.	25.	36.	49.	64.	81.
Cubes	1.	8.	27.	64.	125.	216.	343.	512.	729.

Tyro. How is the *Cube Root* extracted?

Philo. To give you a Rule for it (I look upon) would be too tireſome for your Memory, as there are many Parts contained in it: I ſhall therefore take an Example or two, and proceed in the whole Proceſs, or Order of the Work.

1. I demand the *Cube Root* of 32768? *Anſ.* 32.

RULE.

Firſt, I make a Dot over every *fourth* Figure, beginning at the Units Place, as in the Margin, and as many Dots as you have, ſo many Places the *Root* will contain, which here are two Places. $3\dot{2}76\dot{8}$

Secondly, Seek the *Root* (or neareſt *Root*) to the firſt Point 32, which (by the *Table*) is 3, and place it in the Quotient, which is the firſt Figure in the *Root*, thus, $3\dot{2}76\dot{8}$(3.

Thirdly, Cube the Figure which you put in the Quotient (that is, 3×3×3=27) and place it under the firſt Point 32, and ſubtract it therefrom, thus,

32768(3
27
———
5

Fourthly, To this Remainder (5) bring down all the Figures of the next Point (*viz.* 768) and place them by the Side of the Remainder, and call this the *Reſolvend*, Thus,

32768(3
27
———
5768 *Reſolvend*

Fifthly, Triple the Quotient (that is, always multiply it, by 3 (be it what it will) and place the Units Place of it under the Tens Place of the *Reſolvend*, and call that the *Triple Quotient*. Thus,

32768(3
27
———
5768 *Reſolvend*
———
9 *Triple Quotient*

Sixthly, Now ſquare the Quotient (that is 9) and triple that Square, that is 27, and place the Units Place of it under the Tens Place of the *Triple Quotient*; that is, place it one Figure more to the Left-hand, and call it the *Triple Square*, thus,

Seventhly, Add theſe two laſt together, and call it the *Diviſor*. Thus,

32768(3
27
———
5768 *Reſolvend*
———
9 *Triple Quotient*
27 *Triple Quotient*
———
279 *Diviſor*

Eighthly, Aſk how many Times the *Diviſor* is contained in the *Reſolvend*, rejecting the laſt Figure as you did in the *Square Root*; that is, aſk how many Times 279 you can have in 576, the *Reſolvend*, which here is 2, and place *this* alſo in the Quotient, which now is 32.

Thus,

```
32768(32
27
-----
 5768 Reſolvend
-----
    9 Triple Quotient
   27 Triple Square
-----
  279 Diviſor
```

Ninthly, Cube the Figure laſt put in the Quotient (*viz.* 2, whoſe Cube is 8) and place the Units Place under the Units Place of the *Reſolvend*.

```
32768(32 Root
27
-----
 5768 Reſolvend
-----
    9 Triple Quotient
   27 Triple Square
-----
  279 Diviſor
-----
    8 Cube of 2
```

Tenthly, Multiply the Square of the Figure laſt put in the Quotient (*viz.* 4) into the *T. Quotient viz.*×9. (which is 36) and place the Product one Figure more towards the Left-hand.

```
32768(32 Root
27
-----
 5768 Reſolvend
-----
    9 Triple Quotient
   27 Triple Square
-----
  279 Diviſor
-----
    8 Cube of 2
   36 The Square of 2 by T. Quotient
```

Eleventhly, Multiply the *Triple Square* (*viz.* 27) by the laſt Figure put in the Quotient, and place this alſo one Figure more towards the Left-hand, which is 54.

Twelfthly, Add theſe 3 laſt Numbers together as they ſtand, and call it the *Subtrahend*, which is 5768 equal to the *Reſolvend* 5768.

```
32768(32 Root.  Anſ.
27
-----
 5768  Reſolvend
-----
    9  Triple Quotient
  27   Triple Square
-----
  279  Diviſor
-----
    8  Cube of 2
   36  Square of 2 by T. Quotient
  54   Triple Square by the Root 2
-----
 5768  Subtrahend
```

Thus is the Work finiſhed, and the *Cube Root* of 32768 is found to be 32.

PROOF,

For the Proof of this I multiply 32 by 32, and it is 1024, which 1024 I multiply by 32 again, and have 32768.

Note 1. If the *Subtrahend* had been larger than the *Reſolvend*; then I muſt put a leſs Figure in the ſecond Place in the Quotient, and proceed as before directed.

Note 2. When there is another Point of Figures to take down, firſt, ſubtract the *Subtrahend* from the *Reſolvend*, and to the Remainder bring down the next Point, calling it *New Reſolvend*, or *Second Reſolvend*: Then proceed to work as after the *firſt Reſolvend* in every Reſpect.

2. *Another*

2. *Another Method to extract the* Cube Root, *which is in many Reſpects eaſier and ſhorter than the former.*

Let us take the laſt Example 32768.

Firſt, Find the Root of the firſt Point, as before, and ſubtract it therefrom, and to the Remainder bring down the next Point of Figures, and call it *Reſolvend*, or *Dividend*, which you pleaſe.

Secondly, Square the Root, and multiply it by 300 for a *Diviſor*; and, as in common *Diviſion*, ſee how many Times it is contained in the *Dividend*, and place it in the Quotient, or Root, accordingly.

Thirdly, Multiply the *Diviſor* by the laſt Figure of the Root, and place it under the *Dividend* (Units under Units) drawing a Line between them.

Fourthly, Square the laſt Quotient Figure, and multiply it by the firſt Quotient Figure, and that Product multiply by 30, and ſet this under the laſt Work, Units under Units, &c.

Fifthly, Cube the laſt Figure, and put the Units of this under the Units of the laſt, and add theſe three together in Order, as they ſtand, which is the *Subtrahend*; which, if it be more than the *Reſolvend*, or *Dividend*, you muſt put a leſs Figure in the Quotient, and proceed as before; but if it be leſs than the *Dividend*, ſubtract it therefrom, and the Work is done, for two Figures in the Root: But if there be more Figures, bring them down to the Remainder, and call it a *New Dividend*; and ſquare the whole *Root*, and multiply it by 300, for a *New Diviſor*, and put the Figures in the Quotient. Then ſquare this laſt Figure, and multiply it by the foregoing Figures in the Root, and then by 30. *Laſtly*, Cube the laſt Figure, and place it as before directed, and the Work is done for three Places. The ſame to be obſerved for more Figures.

Thus, the laſt Example 32768(32 *Root. Anſ.*
27

Diviſor 2700) 5768 *Dividend*

5400
360
8

5768 *Subtrahend.*

Tyro. I underſtand it very well, and I think this laſt Way the eaſieſt.

Philo. Take your Choice, as I obſerved before; I ſhall now only ſet you one Sum at large, the firſt Way, which you may prove by the ſecond.

2. What is the *Cube Root* of 12812904? *Anſ.* 234.

12812904(234	*Root. Anſ.*
8	
4812	*Reſolvend*
6	*Triple Quotient*
12	*Triple Square*
126	*Diviſor*
27	*Cube of* 3
54	*Square of* 3 *by T. Quotient*
36	*Triple Square by the Root* 3
4167	*Subtrahend*
645904	*New Reſolvend*
69	*Triple Quotient*
1587	*Triple Square*
15939	*New Diviſor*
64	*Cube of* 4
1104	*Square of* 4 *by T. Quotient*
6348	*Triple Square by the Root* 4
645904	*New Subtrahend* = *New Reſolvend.*

This you may eaſily prove the other Way at Leiſure. Alſo 234×234×234=12812904.

QUESTIONS *for Practice.*

3. What is the *Cube Root* of 5396209064? *Anſ.* 1754.

4. I demand the Cube Root of 9423479350146861? *Anſ.* 211221.

To extract the Cube Root *of any* Vulgar *or* Decimal Fractions.

5. What is the *Cube Root* of $\frac{27}{1331}$? *Anſ.* $\frac{3}{11}$.
6. What is the *Cube Root* of $\frac{2197}{9261}$? *Anſ.* $\frac{13}{21}$.

Extract the *Cube Root* of the Numerator and Denominator for a new Numerator and Denominator.

7. Extract the *Cube Root* of 32.768 *Anſ.* 3.2.
Proceed as in *Whole Numbers*, only prick off as many Decimals in the Root as you have Dots over the Decimals.

Note, As in the *Square Root* you added either 2, 4, 6, *&c.* Cyphers to the Decimal; ſo here you muſt add by *Three*'s, that is, you muſt add either 3, 6, or 9, *&c.* Cyphers.

8. What is the *Cube Root* of .002? *Anſ.* .1259, and .4383021 remains.

SECTION II.

The Uſe of the CUBE ROOT.

9. THERE is a *Cube*, whoſe Solidity is 1372 Feet, I demand the Side of a *Cube*, whoſe Solidity is 4 Times leſs? *Anſ.* 7.
Divide 1372 by 4, and extract the *Cube Root*.

10. If a Bullet 2 Inches Diameter weigh 3 *lb.* what will one of the ſame Metal weigh which is 8 Inches Diameter? *Anſ.* 192 *lb.*

Solids being in triple Proportion to their Sides, or Diameters, it is thus ſound.

As the *Cube* of the given Diameter is to the Weight, ſo is the *Cube* of the other Diameter to the Weight of the other required.

12. Suppoſe a Shot of 4 Inches Diameter weighs 18 *lb.* I demand the Diameter of another, that weighs 144 *lb.* *Anſ.* 8 Inches. This is the Reverſe of the laſt Queſtion.

13. There is a Sphere, or Globe, whoſe ſolid Content is 250047 Inches: I demand the Side of a *Cube*, whoſe *Solidity* ſhall be equal to the *Solidity* of the *Globe*. *Anſ.* 63 Inches.

14. A Country Farmer lent his Neighbour out of his Hay-Stack 20 Feet of Hay in Length, Breadth, and Depth, and his Neighbour brought him Home 10 Feet at one Time, and 10 at another: How is the Balance, and who Debtor? *Anſ.* 6000 Feet due to him that lent it; he having received but $\frac{1}{4}$th.

15. Suppoſe a Ship 300 Tons Burthen, 75 Feet by the Keel, 29 $\frac{1}{2}$ Feet by the Beam, and 14 Feet deep in the Hold; I demand the Dimenſions of another Ship of the ſame Make, of 500 Tons Burthen?

Say, as 300 Ton is to 500 Ton, ſo is the Cube of the given Keel to the Cube of the Ship's Keel required, the Cube Root of which is 88.9 Feet. *Anſ.*

And thus for the other two Dimenſions, which I leave for your Practice.

And now, *Tyro*, before I leave you, I will give you a little Hint of *Meaſuring*, *Gauging*, *&c.* which may poſſibly be of Service to you, and your Acquaintance. You muſt expect me to be very ſhort; but you may, by your Care and Diligence, make a better Progreſs.

POSTSCRIPT.

DIALOGUE XVII.

AS this little Treatiſe may fall into the Hands of ſuch Perſons in the Country, who would be glad of an Opportunity of having a Notion of meaſuring a Piece of *Timber*, a *Brick Wall*, a *Ciſtern* of *Malt*, or a common regular Field, or Piece of Land, *&c.* I have (on Purpoſe for their Amuſement, and the Inſtruction of thoſe Youth that have a Fancy this Way) added this *Poſtſcript*, which, I make no Doubt, will be very acceptable to all ſuch as delight to be induſtriouſly employed at leiſure Times: And I perſuade myſelf, it muſt be very agreeable to a Parent, in either of theſe Ways of Life, to ſee his Son diligent and ready at theſe Things; which, tho' he may not meaſure ſo exact, for Want of more Learning, proper Inſtruments, or Experience; yet may come near enough the Truth to give Satisfaction.

Of Flooring, Roofing, *&c.*

Queſt. 1. How many Clinkers, 6 Inches long, and 3 Inches wide, will floor a Stable 17 Feet long, and 9 Feet wide? *Anſ.* 1224.

Multiply the Length of the Stable by the Breadth, gives 153 Feet; this multiply by 144, the Square Inches in a Square Foot, gives 22032 Inches; this divide by 18, the Inches in 1 Clinker, gives 1224 *Anſ.*

Queſt 2. How many Oaken Planks will floor a Barn 60 Feet ½ long, and 33 Feet ½ wide; when the Planks are 15 Feet long, and 15 Inches wide? *Anſ.* 108.

Multiply 60.5×33.5=2026.75. Then 15 Feet×1.25 Feet (*viz,* 15 Inches) gives 18.75 Feet for 1 Plank: Now 2026.75÷18.75, gives 108 Planks.

Queſt. 3. A Thatcher thatches a Barn 60 Feet long, and 25 Feet wide, and the 2 Porches are each 15 Feet long, and 10 Feet deep, I demand how many Squares are contained in it? *Anſ.* 33 Squares. *N. B.* 100 Feet is 1 Square.

Multiply 60×25 gives 1500 Feet for 1 Side, which doubled, gives 3000 for both the Sides; then the Porch, *viz.* 15×10, gives 150 for 1 Side, which doubled, gives 300, which added to 3000 is 3300, which divided by 100 (that is, cutting off 2 Figures) gives 33 Squares.

2. *Of* Paving, Painting, Wainſcotting, *&c.*

Tyro. How is *Paving, Painting,* and *Wainſcotting* meaſured?

Philo. By the Square Yard; 9 Square Feet being 1 Yard.

Queſt. 4. A Gentleman has a Walk 22 Yards long, and 12 Feet wide, which is paved of Stone; how many Yards does it contain? *Anſ.* 88 Yards.

Firſt, multiply 22 Yards, *viz.* 66 Feet by 12, gives 792, which divide by 9, gives 88 Yards.

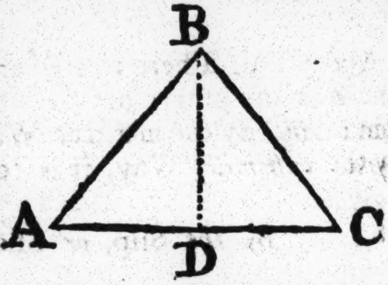
Queſt. 5. There is a Room 64 Feet round, and 9 Feet high, in which are two Windows, each 6 Feet high, and 3 Feet wide, and the Fire-place contains 9 Square Feet; I demand how many Yards of Paper, half Yard wide, will hang it? *Anſ.* 118 Yards.

Firſt, $64\times9=576$ Yards, the Content, out of which take 18 Feet, each Window, *viz.* 36 Feet, and 9 the Fire-Place, is 45; and the Remainder is 531 Feet; which divide by 9, gives 59 Yards, the Content of the Room; but as the Paper is ½ Yard wide only, it will take double this Number, *viz.* 118 Yards *Anſ.*

Painting, Wainſcotting, &c. are done by the Yard Square, and meaſured after this Manner.

To meaſure the Peak End of a Houſe, or any Triangle.

Queſt. 6. Let *A B C* be the Peak End of a Roof, whoſe Baſe *A C* meaſures 24 Feet, and the Perpendicular Line *B D* from the Top of the Peak 16, I demand how many Square Yards it contains?



Multiply ½ the Perpendicular *B D* by the whole Baſe, or Line *A C*; or elſe, multiply the whole Perpendicular *B D* by ½ the Baſe *A C*, *viz.* *A D*, or *C D*, gives the Content in Feet, which divide by 100, gives the Squares, or by 9, gives Square Yards.

Thus *A C* 24 Feet multiplied by ½ *B D*, 16 Feet, (*viz.* 8 Feet) gives 192 Feet, *viz.* 1 Square, 92 Feet; or divided by 9, gives 21 ⅓ Square Yards of Plaiſtering. And thus for any other Triangle.

3. *Of* Board *and* Timber-Meaſure.

1. If the Board be regular, multiply the Length in Inches by the Breadth in Inches, and divide by 144, gives the Anſwer. Or, multiply the Length in Feet by the Breadth in Inches, and divide by 12, gives the Anſwer.

Queſt. 7. There is a Board 9 Feet long, and 10 Inches wide; how many Feet does it contain? *Anſ.* 7 ½ Feet.

If the Board be wider at one End than another, the true Way is to multiply the Ends together, and extract the Square Root for a *Mean Breadth*. But Cuſtom has brought up an eaſier Way, though not ſo true, *viz.* add the Breadth of both Ends together, and take the ½ for a *Mean Breadth*, which multiply the Length by, as before directed.

Queſt. 8. There is a Board 16 Inches at one End, and 8 at the other, and 10 Feet long; what is the Content? *Anſ.* By the firſt true Way, it is very near 9 ½ Feet; by the *cuſtomary* Way, it is 10 Feet.

By the Slip, *or* Sliding RULE.

The Seventh QUESTION *proved.*

Set the Breadth of the Board, *viz.* 10 Inches on the *Slip*, to the upper 12 above on the Rule; then againſt 9 Feet on the Rule, you have 7½ Feet on the *Slip*, the Content required.

Again, Suppoſe a Board be 14 Feet long, and 15 Inches wide, what is the Content? Set 15 on the *Slip*, againſt the upper 12; then, againſt 14 Feet on the Rule, you have 17 ½ Feet, on the Slip, Anſwer.

Tyro. I underſtand you, Sir; but pray how do you meaſure Timber?

Philo. The *cuſtomary Way* is this: With a ſmall String or Cord, take the Circumference of the Tree (which is done in any Place, where the Buyer and Seller can agree) then double this String into 4 Parts, and apply it to your Rule, and that Length is called the *Girt*, or ¼ Part of the Circumference; and it is alſo cuſtomary to abate one Inch of the *Girt*, on Account of the Bark.

2. Having got the *Girt*, multiply it by itſelf, that is, ſquare it, and multiply that Product by the Length of the Tree in Feet, and divide by 144, gives the Content; or multiply it by the Length in Inches, and divide by 1728, gives the Content.

Note, Few Perſons mind leſs than ½ a Foot in the Length of a Tree, except it be very large.

Queſt. 9. There is a Tree 14 Inches *Girt*, and 9 Feet long, I demand the Content? *Anſ*. 12 ¼ Feet.

Firſt, 14 multiplied by 14, is 196, this ×9, the Length =1764 which divided by 144, gives 12 Feet, 36 Inches, which is ¼ of 144.

Queſt. 10. There is a Tree 10 ½ Inches *Girt*, and 12 Feet ½ long, I demand the Content? *Anſ*. 9½ Feet. For 10.5×10.5=110.25×12.5=1378.125÷144=9.57 Feet, or 9 Feet, 82 Inches. *Anſ*.

By the Slip, *or* Sliding RULE,

The Ninth QUESTION *proved*.

Set the Length of the Tree on the Slip (*viz*. 9 Feet) againſt 12 in the Middle of the Rule (wrote *Girt-Line*) then againſt the *Girt* (*viz*. 14) on the *Girt-Line*, you have 12 ¼ Feet on the Slip.

The Tenth QUESTION *proved*.

Set 12 ½, the Length, againſt 12, the *Girt-Line*; then againſt 10½, you have better than 9 ½ on the *Slip* itſelf, *viz*. 9 Feet, 82 Inches.

Of tapering TIMBER.

Some Perſons will take but one *Girt*, though a Tree be very long and tapering; but this is certainly very wrong.

wrong, as it may do Injuſtice to either the Buyer or Seller. The beſt Way is, to meaſure ſuch a Tree, as if it were two or three diſtinct Trees, by taking two or three ſeveral Lengths and Girts.

Some, indeed, take 2 *Girts*, one at the great, and the other at the ſmall End, and add them together, and take the ½ of it for a *Mean Girt* (as in *Board-Meaſure*) but this is a Hurt to the Buyer, and very erroneous; whereas they ſhould multiply one *Girt* by the other, and extract the Square Root for a *Mean Girt*.

Queſt. 11. Suppoſe a Tree 20 Inches *Girt*, at one End, and 40 at the other, and 9 Feet long, I demand the Content?

By the cuſtomary Way the *Mean Girt* will be 30 Inches, and the Content will be 56 Feet, 36 Inches =¼ of another Foot. But, according to the true Way the *Mean Girt* is but 28.28, and the Content but 49.98 Feet, *viz.* 49 Feet, 141 Inches, which is 6 Feet 39 Inches leſs than the other.

Tyro. This is a ſenſible Difference, indeed, in many Loads of Timber.

Philo. Very true.

Note 1. In ſome Counties, 40 Feet make a Load, and in others, 50 Feet make a Load.

Note 2. When there are 50 Feet to the Load, then to caſt up the Content, at any given Price, the Rule is, Multiply the Content, or Number of Feet, by the Price in Shillings, and cut off the three firſt Figures, from the Right to the Left-hand: So will the Figures towards the Left-hand be Pounds Sterling, and the other will be Decimal Parts of a £.

EXAMPLE.

Queſt. 12. Suppoſe I meaſured 6 Trees, and their Content be 548 Feet, at £1 – 10*s.* *per* Load?

I multiply 548 by 30, and it gives 16440, which I cut off thus, 16|440, and it is £16.440, *viz.* £16. 8*s.* 9*d.* $\frac{1}{2}$.

N. B. Stone is meaſured the ſame, only obſerve, 8 Inches make 1 Foot of Stone.

4. Of BRICK-WORK.

Tyro. How is *Brick-work* meaſured?

Philo. By the *Square Rod*, that is, 16 Feet $\frac{1}{2}$ in Length, and 16 $\frac{1}{2}$ in Breadth, make 272 $\frac{1}{4}$ Feet, or 1 Square Rod; but, for common Practice, 272 Feet only is ſufficient.

Tyro. Is there not a certain Standard for the Thickneſs of Brick-work?

Philo. Yes: All Sorts of Brick-work is reduced to the Standard of 1$\frac{1}{2}$ Brick thick, of which I ſhall give you a further Notion by and by.

1. *Of Work at* 1$\frac{1}{2}$ *Brick thick, the Standard.*

Multiply the Length by the Height, in Feet, and divide by 272, the Quotient gives the Square Rods, and the Remainder, the Feet, or Parts of a Rod.

Queſt. 13. A Gentleman built a Brick Wall round his Garden, which was 998 Feet long, 9 Feet high, and 1$\frac{1}{2}$ Brick in Thickneſs: I demand how many Rods it contains. *Anſ.* 33 Rods, 6 Feet.

Here I multiply 998, the Length, by 9, the Height, and it gives 8982 Feet, which I divide by 272, (the Feet in a Rod) and it gives 33 Rods, 6 Feet. *Anſ.*

Tyro. I underſtand it; this is eaſy enough: But ſuppoſe it was but 1 Brick thick, or ſuppoſe it were 2, or 3 Bricks thick, how then?

Philo. Having found the Content, at 1$\frac{1}{2}$ Brick thick, as before directed, ſay thus:

As 3 (the ½ Bricks in the Standard Meaſure) is to the Content in Standard Meaſure, at 1½ Brick thick, ſo is the Number of half Bricks in the Wall, to the Content, at that Thickneſs.

Queſt. 14. There is a Brick Wall 998 Feet round, and 9 Feet high, what is the Content, at 2½ Brick thick?

The Content, at 1½ thick, was found in the laſt Queſtion to be 33 Rods, 6 Feet. Say therefore,

As 3 to 33.6, ſo is 5 half Bricks, *viz.* the Thickneſs, at 2½ Bricks thick to the Content, at that Thickneſs, *viz.* 55 Rod, 10 Feet.

Tyro. I underſtand you well; but cannot any Thickneſs be done at one Operation?

Philo. Yes; for having multiplied the Length by the Height, divide by any of the following Numbers, that are ſet againſt the given Thickneſs, and you have the Content in Rods at once, and the Remainder is Feet.

Note, Though there be Decimals in the *Diviſors*, you may divide by the whole Numbers for common Uſe.

For 1	Brick thick divide by	408.3
1½		272.25
2		204.2
2½		163.3
3		136.12
3½		116.6
4		102.1
4½		90.7
5		81.7

Queſt. 14. There is a Wall 15.5 Feet long, and 9.5 Feet high; what is the Content, at 3½ Bricks thick? *Anſ.* 1 Rod, 2 Tenths: For I multiply $15.5\times9.5=147.25$, which divided by 116.6 the *Diviſor* for 3½ Bricks, gives 1 Rod, 2 Tenths. And thus for any Thickneſs; for at 4½ thick, it is 1.5 Rod, *viz.* 1½.

By the Slip, *or* Sliding RULE.

There is a Wall 9 Feet high, and 76 Feet long, and $1\frac{1}{2}$ Brick thick; I demand the Content? *Anſ.* 2 Rods, 140 Feet, or better than $2\frac{1}{2}$ Rods.

Set 272 on the Slip to the Heighth 9 above it; then againſt 76, the Length on the Slip, is $2\frac{1}{2}$, or better, on the Rule.

A RULE *for any Thickneſs.*

Set any of the former *Diviſors*, anſwering any Thickneſs on the Slip, to the Heighth; then againſt the Length is the Anſwer. Thus the ſame Wall, at 3 Brick thick.

Set 136 to 9, then againſt 76 you have 5 Rods, the Content, at 3 Brick thick.

5. *Of* SURVEYING.

Tyro. How is Land ſurveyed?

Philo. Land-Meaſure is a Part of the Mathematics, and to ſurvey it true, and in a maſterly Manner, you ſhould be provided, 1. With a Chain, called *Gunter's Chain.* 2. A *Caſe of Inſtruments.* 3. A *Parallel Ruler.* 4. A *plain Table.* 5. A *Platting-Scale*, or *Protractor.* And, to make it more complete, a *Theodolite.*

Tyro. But cannot I meaſure a common regular Field, or little Piece of Ground, without all theſe Inſtruments?

Philo. Yes; by a Chain only, or, for Want of that, a Cord, a Rod-Pole, or any ſuch Thing; but this muſt not be depended upon for Truth.

Tyro, Give me a Deſcription of the Chain.

Philo. All Land is now generally meaſured by a Chain, containing 4 Rods, or Poles, in Length (*viz.* 22 Yards) according to a Statute made in the 33d of *Edward* I. *Anno* 1305, which ſays, *That a Square Acre ſhall contain* 160 *Rods, viz.* 40 Rods in Length, and 4 Rods in Breadth, make 160 Rods, or 1 Acre of Ground.

Note, The *Chain* is made of Iron, containing 100 Links, each in Length is 7.92 Inches, (or nearly 8 Inches) 100 of which is 792 Inches, or 22 Yards, (*viz.* 4 Rods.) Therefore, 1 Chain in Length, and 10 in Breadth, or 10 in Length, and 1 in Breadth, make an Acre.

Note 2. For Want of a Chain you may take a Cord 22 Yards, or 4 Rods long, or any Number of Rods long you pleaſe, dividing it into Halves and Quarters, with which you may meaſure any common Field within a Trifle of Truth, or, at leaſt, for common Satiſfaction.

Having provided yourſelf with a Chain, or any convenient Line, if the Field, or Piece of Ground, be regular, *viz.* a Square, or the oppoſite Sides alike; then meaſure the Length and the Breadth, in Rods, or Parts, and multiply the Length by the Breadth, and divide the Product by 160, the Rods in an Acre, you have the Content.

Queſt. 15. There is a Field in the Form of a long Square (called a Parallelogram) whoſe Length is 35 Rods, and Breadth 24 Rods; I demand the Content in Acres? *Anſ.* 5 Acres, 1 Rood.

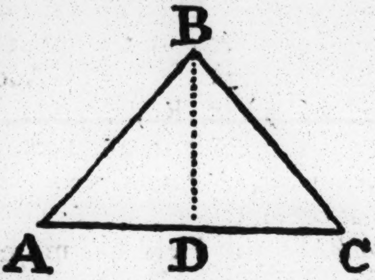
Firſt, I multiply 35, the Length, by 24, the Breadth, and it gives 840 Rods; which I divide by 160, gives 5 Acres, and 40 remains, which I multiply by 4 (becauſe 4 Roods make 1 Acre), and divide again by 160, gives 1 Rood.

Queſt. 16. There is a Square Piece of Ground ſet out upon a Heath, or Common, in Order to form a Camp for 1000 Soldiers, each Side contains 60 Rods; how many Acres does it contain? *Anſ.* $22\frac{1}{2}$ Acres.

For $60 \times 60 = 3600$, which divided by $160 = 22$ Acres, 80 Rods, or $22\frac{1}{2}$ Acres.

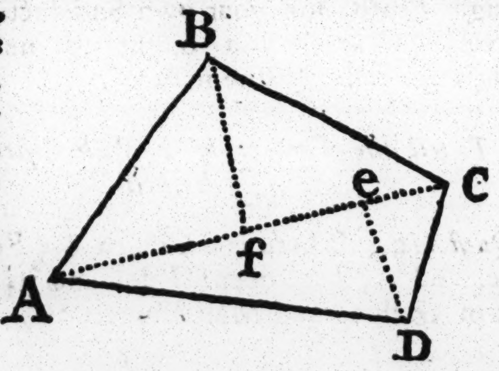
Queſt. 17. There is a 3 ſided or triangular Field *ABC*, the Side *AC* is 51.5 Rods, and the Perpendicular *BD* is 34 Rods; how many Acres does it contain? *Anſ.* $5\frac{1}{2}$ Acres nearly.

Note, You muſt firſt of all meaſure the Side from *A* to *C*, called the Baſe, which ſuppoſe 51 ½ Rods; then meaſure half Way from *A* to *D*, and from *D* meaſure ſtraight up to the Point *B*, which is called the Perpendicular, which ſuppoſe to be 34 Rods: Now, I told you before, that the Baſe multiplied by ½ the Perpendicular gives the Content; that is, 51.5 multiplied by 17 (½ the Perpendicular) gives 879.75, which divided by 160, gives 5.49 Acres; that is, very near 5½ Acres.



To meaſure any four-ſided Field, whoſe Sides are unequal, called a Trapezium.

Queſt. 18. There is a *Trapezium*, or four-ſided Field, or Piece of Ground, *A B C D*, whoſe Baſe *A C* is 64 Rods, and the Perpendicular *B f* is 60, and the other Perpendicular *D e* is 40: I demand the Content in Acres? *Anſ.* 20 Acres.



First, To meaſure this Field, go ſtraight croſs it from the Corner *A* to the Corner *C*, which here is called the Baſe, and meaſures 64 Rods: Then meaſure right ſtraight from the Point *B* to *f*, which is 60 Rods, and right ſtraight from *D* to *e*, which is 40 Rods. This done, the Rule is,

Multiply the whole Baſe *A C* 64 by ½ *B f* 60, (*viz.* 30) and it gives 1920 Rods, the Content of the Triangle *A B C*: Then again multiply the Baſe *A C* by ½ *D e* 40 (*viz.* 20) and it gives 1280 Rods, the Content of the Triangle *A C D*. Add thoſe 2 together, *viz.* 1920, and 1280 Rods, gives 3200 Rods, which divide by 160, the Rods in an Acre, gives 20 for the Anſwer.

Tyro. Sir, I thank you; this is enough for my Purpoſe at preſent.

Philo. If the Field has more Sides, you may meaſure it after the ſame Manner, by dividing it into Triangles, always remembering to multiply the Baſe by ½ every Perpendicular that falls upon it.

5. *Of* GAUGING.

Tyro. How may I *gauge*, or tell the Content of any common Cooler, or regular Caſk, or Ciſtern, in Gallons, or Buſhels.

Philo. I ſhall give you ſome ſhort Inſtructions, by which you may tell the Content of ſeveral Things near enough Truth, for your own Satiſfaction: But to be a practical *Gauger*, you ought to underſtand ſeveral Branches of the Mathematics.

1. *To tell the Content of a Malt Ciſtern in Gallons and Buſhels.*

Queſt. 19. There is a Ciſtern 6.5 Feet long, 4 Feet wide, and 3.5 Feet deep: I demand its *Area*, and Content in Gallons and Malt Buſhels?

Note 1. *Area* ſignifies the ſuperficial Content, or Content at one Inch deep; which multiplied by the Depth, gives the Content itſelf.

Note 2. That 282 Inches make 1 Gallon of Ale, Water, &c. 231 a Gallon of Wine, and 2150 Inches 1 Buſhel, which are your Diviſors for all regular Figures.

RULE.

RULE.

Multiply the Length, 78 Inches, by the Breadth, 48, and it gives 3744 Inches, which divide by 282, gives 13.276, the Area, at 1 Inch deep, or divide by 2150, gives 1.741, the Area in Buſhels. The Area multiplied by the Depth, 42 Inches, gives 557.592 Gallons. The Area for *Malt* multiplied by 42, gives 73.122. the Content in Buſhels.

Note, If the Area be not required, or you do not underſtand Decimals, you may more eaſily find the Content at once, thus: Multiply the Length, Breadth, and Depth, in Inches together, gives 157248, which divide by 282, gives 557 Gallons $\frac{1}{2}$, or 157248 divided by 2150, gives 73 Buſhels $\frac{1}{10}$ as before.

To find the AREA *by the* Sliding Rule.

Set 282 upon *B* to 48, the Breadth on *A*; then againſt 78, the Length on *B*, is 13.276, the Area in Gallons.

For *Malt*. Set 2150 on *B* to 48 on *A*; then againſt 78, the Length on *B*, is 1.741 on *A*, the Area in Buſhels: And thus for any regular Figure.

To gauge a Tub or Cooler in the Form of a Cylinder, viz. *whoſe top and bottom Diameters are equal.*

RULE.

Square the Diameter, *viz.* multiply it by itſelf, and this Product by the Depth, then divide by 359 for Beer Gallons, 294 for Wine, and 2737, (or rather by 2737.47) for Malt.

Queſt. 20. There is a Tub 4 Feet, 2 Inches, Diameter, and 3 Feet, 4 Inches, deep: I demand the Content in Beer, Wine, and Malt?

I ſquare the Diameter 50, which is 2500, and multiply this by the Depth, 40 Inches, gives 100000; which divide by 359, gives 278 Ale Gallons; divide by 294, gives 340 Wine Gallons, and by 2737 only, gives 36.5 Malt Buſhels.

Note, If the Figure be the Form of a *Triangle*, or *Trapezium* (as in *Queſtion* 17 and 18) you muſt proceed to meaſure them as there directed, and after having multiplied by the Depth, divide by 282 for Beer, 231 for Wine, and 2150 for Malt, gives the Content.

Queſt. 21. There is a Tub, whoſe Top Diameter is 40 Inches, Bottom 30 Inches, and the Depth 60 Inches: I demand the Content in Beer, Wine, and Malt.

There are ſeveral Ways to do this. One is this, multiply the Diameters together, and extract the Square Root for a mean Diameter, which is here 34.64. This multiplied by itſelf, and divided by 359, gives the Content in Gallons, or by 2737, gives the Malt Buſhels.

Or more eaſily thus, though not ſo true.

Add the Diameters together, and take the ½ for a *Mean*, is 35. Now 35×35=1225×60=73500, which divided by 359, gives about 205 Gallons; and ſo for Malt, *viz.* gives 26 Buſhels $\frac{8}{10}$.

For a Couch of MALT.

1. If it be a regular Square only, multiply the Length, Breadth, and Depth together, and divide by 2150, gives the Buſhels.

2. If it be a *Triangle*, or *Trapezium*, proceed as before directed, and divide ſtill by 2150.

Tyro. But ſuppoſe the Couch be uneven, how ſhall I tell where to take the Depth.

Philo. Take the Depth, at 4 or 5 Places, add them all together, and divide by the Number of Places you took the Depth at, for a mean Depth.

Queſt. 22. There is a Bed, or Couch of Malt, in the Form of a long Square, whoſe Length is 35 Feet, Breadth 16 Feet, and I find the mean Depth to be 8.5 Inches, *viz.* 8½ Inches; I demand the Content.

Thus, 420 Inches ×192=80640×8.5=685440; this divided by 2150, gives 318.8 Buſhels.

Of Caſk Gauging.

There is a great Variety in gauging Caſks; but the following Methods will be near enough Truth, for all common Caſks, ſuch as Barrels, Butts, *&c.* that are pretty much bulged.

Firſt, Having taken the Bung and Head Diameters, the Rule is, To the Sum and ½ the Sum of the Squares of the Bung, and Head Diameters, add ½ the Difference of the ſaid Squares: This Sum multiply by the Length, and divide by 1077 for Beer, and 882 for Wine Gallons.

2. *Rule*, which is as true, and much eaſier.

To the double Square of the Bung Diameter add the Square of the Head Diameter; then multiply this Sum by the Length of the Caſk, and divide by 1077 for Beer, or 882 for Wine.

Queſt. 23. There is a Caſk, whoſe Bung Diameter is 28 Inches, Head Diameter 25 Inches, Length 36; I demand the Content in Ale Gallons?

Firſt, The Square of the Bung Diameter 28 is 784; which doubled is 1568. Then the Square of the Head, *viz.* 25×25=625, which added to 1568, is 2193; this ×36, the Length is 78948, which divided by 1077, gives 73 Gallons, 2 Pints, for Beer, and divided by 882, gives $89\frac{1}{2}$ Gallons, Wine or Brandy.

Note 1. If you find the Area of the Bung, and Head Diameters (by *Queſtion* 20) and add twice the *Area* of the Bung, *viz.* 2.184 to the *Area* of the Head 1.741 it is 6.109, which multiplied by $\frac{1}{3}$ of the Caſk's Length, *viz.* 12, gives 73 308 Gallons, as before.

Theſe Methods holding good for moſt Caſks, I ſhall give no more Examples.

Note 2. If one of the Head Diameters be larger than the other, and the Caſk is ſtraight in the Sides, like ſome Churns, then (by *Queſtion* 21) find a mean Diameter throughout, and proceed as therein directed.

And now, *Tyro*, I muſt leave theſe Things to your further Conſideration, and bid you farewel; and I hope you will take Care to improve yourſelf in them, rather than trifling away your Time with idle Fancies: For it is evident, that the Knowledge of *Arithmetic* is neceſſary in every Station of Life, ſince almoſt all Manner of Buſineſs depends upon it: And not only this, [illegible] but it is a great Help to [illegible] us againſt the Frowns of Fortune, and keeps us (by being qualified for ſome lawful Poſt, or Employment) from thoſe common Temptations and Misfortunes, to which thoſe, who know the Want of it, ſo often fall into, and pay for ſo dearly.

Tyro. I return you Thanks for this Advice, and hope, I ſhall make ſuch Uſe of it as may not fruſtrate your good Deſigns.

Philo. I hope you will not only do it yourſelf, but be as ready to ſerve others, whenever it lies in your Power. And now, *Tyro*, I once more wiſh you a hearty Farewel.

Tyro. Sir, I am your humble Servant.

FINIS.

S B

[illegible]

His Book Decbr

BIBLIOTHECA · HOM

D D

Bo

10